VEGETATION SURVEY and MANAGEMENT RECOMMENDATIONS

Homestead National Monument of America

Professor Richard K. Sutton

Dr. James Stubbendieck

Ms. Jayne Traeger

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FOR

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by

Professor Richard K. Sutton

Dr. J. Stubbendieck

and

Ms. Jayne Traeger

Natural Rescources Enterprises, Inc.

P. O. Box 4523

Lincoln, Nebraska 68504

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ABSTRACT

The management history and existing condition of the vegetation at Homestead National Monument of America (HMNA) were investigated from August, 1982 through December, 1984. The major tasks were 1) to document condition of the prairie, 2) to prepare an herbarium collection, and 3) to provide a prairie management action plan. A general overview of potential prairie restoration and management techniques was also provided. These techniques included discussions of seeds and seeding, mulches, irrigation, forb enrichment, transplanting, grazing, mowing, haying, weed control, and burning.

As a result of the investigation, several critical areas of concern were noted: lowland prairie, existing State Highway 4 right-of-way, old State Highway 4 right-of-way, extant osage-orange hedgerow, offsite erosion, onsite upland erosion, tree intrusion into lowland prairie, disturbed lowland prairie with perennial weeds, location and use of pioneer crops area, woodland, Freeman School prairie remnant, shrub edge, and shrub intrusion into prairie.

The three major plant communities were upland prairie, lowland prairie, and woodland. The study and intensive management recommendations focused on the prairie types. Vegetation sampling results show previous attempts to restore prairie species have been successful on the uplands. The lowlands, however, have failed to respond favorably to several seeding attempts. This report recommends a target species composition based on information in Dr. J. E. Weaver's <u>North American Prairie</u>.

INTRODUCTION

The purpose of this report is to summarize the results and recommendations of a vegetational survey and management analysis of the Homestead National Monument of America conducted by Natural Resources Enterprises, Inc. between August, 1982 and December, 1984. Major focus will be on the prairie, but comments will be made regarding the woodlands and hedgerow.

THE SITE

Homestead National Monument of America (HNMA) is located five miles west of Beatrice, Nebraska, on 160 acres first homesteaded by Daniel Freeman. Congress set aside the 100 acres of formerly abused pasture and cropland and 60 acres of woodland as a permanent monument to the homesteading era. The Freeman School, adds a noncontiguous 1.5 acres to the monument. Physical features of the site are dominated by Cub Creek, a major tributary to the Big Blue River, and its adjacent bottomlands. The balance of the site is made up of moderately steep glacial till slopes with eroded sandy and gravelly side slopes.

MANAGEMENT HISTORY

Because of the importance of prairie to the settler, The primary objective of HNMA has been restoration of the landscape context to the what approximate original condition as encountered by Daniel Freeman in the mid-1860's. This goal has been evident from the first management masterplan written by Adoph Murie circa 1938 (Appendix I-1). Murie says in his report, Restoration of Native Grassland at Homestead National Monument,

> "E. A. Hummel, Regional Historian, is making plans to restore the conditions of the homestead as they were when the homesteader, Mr. Freeman, first settled on it. Among other things, Hummel wishes to restore the native vegetation so far that it is possible..."

Murie went on to describe two possible restoration methods, one was transplanting of sod from a local prairie doomed to destruction by plowing, and the second was by seeding. He also realized the advantages to sodding in that,

> "...not only is prairie grass brought into the area, but also native species of prairie herbs."

In preparing this first management plan, Murie had been in contact with the eminent prairie ecologist, Dr. J. E. Weaver of the University of Nebraska, who felt that this project,

> "...contained the possibilities of an excellent experiment..."

The natural history of a landscape untouched by modern man´s activities is at best a complex mosaic of reactions to previous ecological perturbations. For example, prairies are unique plant communities, associations, and formations which resulted over thousands of years of cyclic drought, temporary heavy grazing, and fire among other events. When man´s activities are added, this mosaic becomes even more complex, especially when those activities have not been recorded in time or space. Much of the existing site condition is directly related to the management practices conducted over time in response to previous factors and the objective of prairie restoration. However, uncontrollable natural events, such as flooding and wild fires, still impact the site. Following is a chronological listing of human management intents, coupled with natural events, setting the stage for ongoing management.

When the site was acquired by the National Park Service, severe erosion had occurred on the upland slopes, heavy depositions of silt were on the lower slopes, and the woodlands were cutover and heavily grazed. Management during the early years at HNMA centered around stabilizing a severely abused soil and protecting newly planted native grasses.

As stated in the RFP-MWR-2-36 dated June, 1982,

> "...most of the area was cultivated until the
> early 1930's."

Photograph #140 (Figure 1) and photograph #1015 (Figure 2) show that the southeast 40 acres was under cultivation. These photographs were taken in March and November of 1939, respectively. Although the RFP-MWR-2-36 states that seeding occurred as early as 1937, a search of past records indicates that the first seeding took place in 1939 with seed gathered approximately five miles to the west. Job records at HNMA indicate that the approximate mixture was 45% big bluestem; 50% little bluestem; 1% each of Kentucky bluegrass, needleandthread, indiangrass, prairie dropseed, and sideoats grama. The first sodding was also carried out in 1939 to control severe sheet, rill, and gully erosion on the coarse-textured south upland slopes. Source of the sod is unknown.

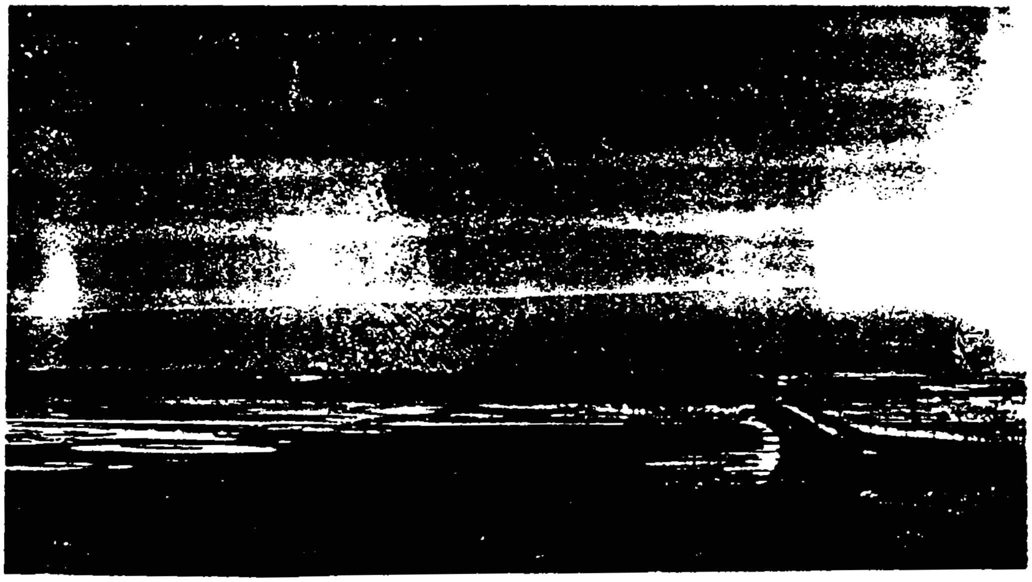

Figure 1. NPS negative #140, March, 1939. View west along the old State Highway 4 right-of-way. This photo shows the general condition of the cropped upland and overgrazed woodland. Trees adjacent to the Agnes Suiter Freeman cabin are probably volunteers (Photo by E. A. Hummel).

Figure 2. NPS negative S & MC #6,1015, November 1, 1939. Looking east from Quadrat 16 in the southeast 40 acres. The general ground cover is the prairie at the end of the first growing season. In the center are narrow prairie sod strips to control rill and sheet erosion (Photo by E. A. Hummel).

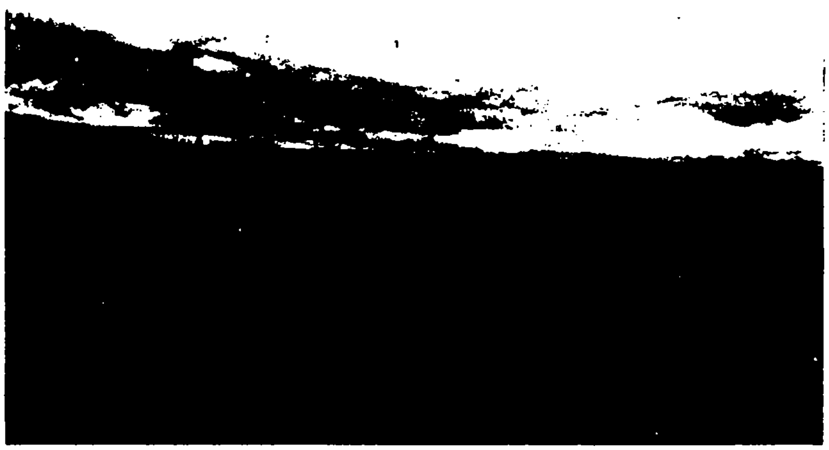

Figure 3. NPS negative S & MC #31, 1034, May 1, 1942. Facing east looking across Quadrat 16. Generally, the same view as Figure 2 showing the three years of erosion. Note the sparse establishment of the prairie grasses (Photo by Mr. Fletcher).

Figure 4. NPS negative S & MC #35, 1037, May 1, 1942. Brush dam in Quadrat 14. View looking south. Note the unmanaged appearance of the osage-orange hedgerow (Photo by Mr. Fletcher).

Figure 5. NPS negative S & MC #34,1035, May 1, 1942. Main drainage in Quadrat 15 looking south. Note the check dam and delta of silt at approximately the 1275 contour. Also note the weeds trapped by the hedge and that the hedge to the east of the drainage is noticeably shorter, probably from the harvesting of osage-orange fence posts (Photo by Mr. Fletcher).

Figure 6. NPS negative S & MC #37, 1038, May 1, 1942. View northwest across Quatrat 14. Note check dams in foreground. Also note the strong linear character of the volunteer trees and shrubs along what is now the old State Highway 4 right-of-way (Photo by Mr. Fletcher).

Figure 7. NPS negative S & MC #33, 1036, May 1, 1942. This photo shows erosion in the southeast 40 acres. However, in the top center, a dense patch of established prairie vegetation stands out from the surrounding clumps. This probably is an area that was sodded four years earlier (Photo by Mr. Fletcher).

1949 - The first use of herbicide, other than sodium chlorate, at HNMA was recorded in 1949 with an application of 2,4-D on bur ragweed, primarily in the woodlands. Continued mulching with old hay occurred on the upland gullies. Concern was noted about the poor drainage on the lowland prairie.

1950 - The major event was a large flood on October 2nd and 3rd which covered the lowlands.

1951 - A visit by Dr. E. J. Dyksterhuis of the Soil Conservation Service resulted in some specific recommendations which, if adopted, would provide a changed and more finely tuned management plan than had been followed (Appendix I-2). The significant recommendations can be summarized as follows: 1) no grazing, 2) mow before July 15th, 3) timely clipping of downy brome infested areas, 4) no herbicide use in the prairie because of its detrimental influence on forbs, 5) importance of legumes, 6) supplement lowlands with other species by sod chunks, 7) fire is a hazard but is compatible with prairie, 8) because of weedy perennials in the southwest bottomland, clean till and start over by seeding lowland species, 9) one the east 40 acres of hillside, fertilize, mulch, and mow with a high cutter bar to spread clumps, and 10) do not disturb the lowland silt delta, because the weedy annuals will eventually be out competed by the perennial prairie plants. Some of these recommendations were followed, and others were not. The east 40 acres was mowed, except on the gravel side slopes.

1952 - A massive creek bank stabilization project with willow plantings was initiated. The uplands were hayed, except for the gravel side slopes.

1953 - The Gage County Soil Conservation District harvested seed in the east 40 acres. The bottomland was hayed.

1954 - C. H. Schultz, HNMA Custodian, noted that the heavy thatch of 1945-51 was now depleted. Seeds were harvested as they were in 1953. Erosion was noted along the abandoned State Highway 4 right-of-way.

1955 - A review of the areas by J. Dexter Haws of the Soil Conservation Service resulted in detailed recommendations (Appendix I-3). In summary, he 1) noted a sweetclover infestation, 2) noted a smooth bromegrass infestation, 3) noted several other weeds that would not be future problems, 4) suggested planting prairie cordgrass in the wet lowlands and along the stream banks, and 5) suggested planting native shrubs in the gullies. The NPS replied somewhat negatively to some of these recommendations (Appendix I-5).

1956 - A report was made by the NPS regional soil conservationist (Appendix I-6).

1957 - A major June flood covered the lowlands. Dr. Calvin McMillian, Department of Agronomy, University of Nebraska, requested from the NPS the origin of the seed source in restoration (Appendix I-7).

1958 - No major activities.

1959 - A major Dutch elm disease program was initiated.

1960 through 1962 - HNMA management master plan (Appendix I-8).

1963 - Major June flooding on the lowlands. Use of 2,4-D ester was noted (Appendix I-9).

1964 - A year after a flood in the lowlands found these areas heavily infested with weeds. This sparked an ongoing weed control program from 1965-80 using Dalapon for bromegrass control and 2,4-D for broadleaf weeds.

1965 - A thatch buildup resulted in mowing the complete area (Appendix I-10).

1966 and 1967 - No major activities.

1968 - Smooth bromegrass in the north 40 acres was mowed, raked, and baled in June. A flood on August 19th covered the lowlands. The lowland area in the north 40 acres was plowed on September 28th.

1969 - The lowland area was disked in June, sowed to milo in July, mowed in September, 7 to 11 acres were seeded in November, and in December the Soil Conservation Service recommended that future seedings include forbs.

1970 - The first controlled burn of the prairie, excluding the newly planted areas, was conducted. The newly planted areas were mowed, and 2,4-D was applied (Appendix I-11).

1971 through 1974 - No new major activities.

1975 - About 4 acres of the most recently seeded area was reworked (Appendix I-12).

1976 - The year was extremely dry. The 4 acres of lowland were reseeded in November.

1977 - Plants in the 7 to 11 acre lowland area were under drought stress and were weed infested.

1978 and 1979 - Woody invaders were removed from the lowlands with Ortho Brush Killer. The routine 2,4-D spraying program was stopped in 1979.

1980 - A 17-acre wild fire occurred.

1981 - No major new activities.

1982 - A major flood covered the lowlands in June. A pre-scribed burn in April was stopped by rain after burning 8 acres. Manual removal of thistles and common mullein was initiated. Native hay bales were used for erosion control in Quadrats 14 and 15 (Figures 8 and 9).

1983 - Removal of native and exotic species from the osage-orange hedgerow was initiated. The entire prairie was included in a prescribed burn in April. Manual weed removal continued, and plant material from 4 weedy acres of lowland was mowed and burned in August (Appendix I-13).

1984 - A portion of the weedy lowland was mowed. A few plum thickets were shredded at a height of about 2 feet. The area north of State Highway 4 was burned in the fall. Manual removal of weeds continued.

This chronological summary shows a clear change in problems as the prairie at HNMA has evolved. Erosion and stabilization has given away to interest in more natural and biological management controls. For example, prescribed burning has replaced mowing and the use of herbicides. A logical, progressive understanding that these procedures can be integrated and selected to obtain certain results has occurred. Interest has also moved from native grasses in the early stabilizing years of HNMA management in the 1930's and 1940's, to an interest in legumes in the 1950's, and on to a more recent and more complex understanding of the role of forbs. Forbs, in general, help HNMA to more closely approximate the original flora, add visitor interest, and add potential interpretation activities. A recent concern has emerged about the use of a local gene pool source for future introduction of plants, which indicates a further evolution of understanding of the prairie ecosystem.

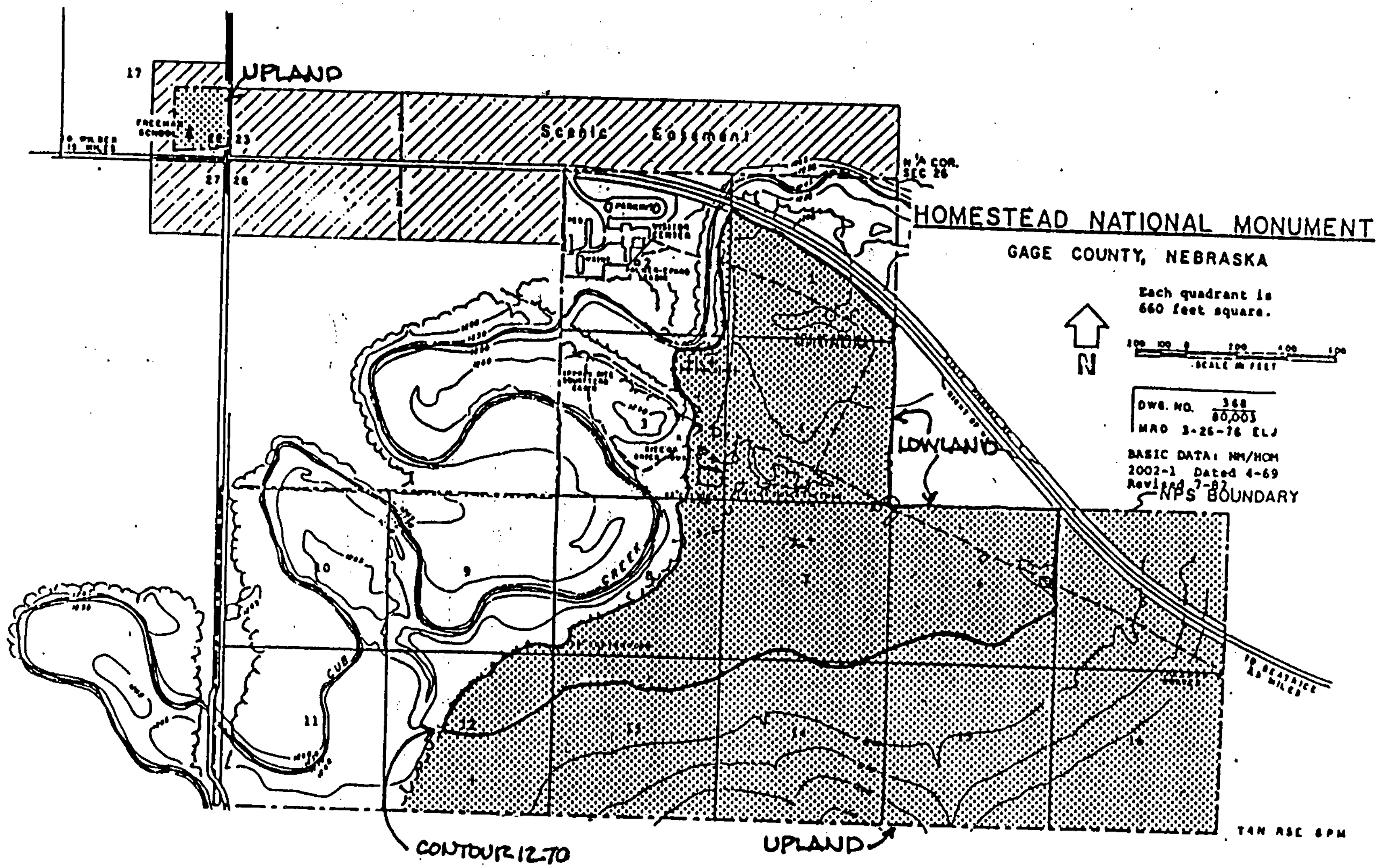

Figure 8. MANGEMENT UNITS

1. Disturbed Lowland Prairie
2. Highway 4 R-O-W
3. Old Highway 4 R-O-W
4. Osage Orange Hedgerow
5. Offsite Erosion
6. Upland Gully Erosion
7. Tree Intrusion
8. Perennial Weeds In Lowland Prairie
9. Pioneer Crops Area
10. Woodland
11. Woodland North of Highway
12. Freeman School Prairie Remanant
13. Shrub Edge
14. Shrub Intrusion Into Prairie

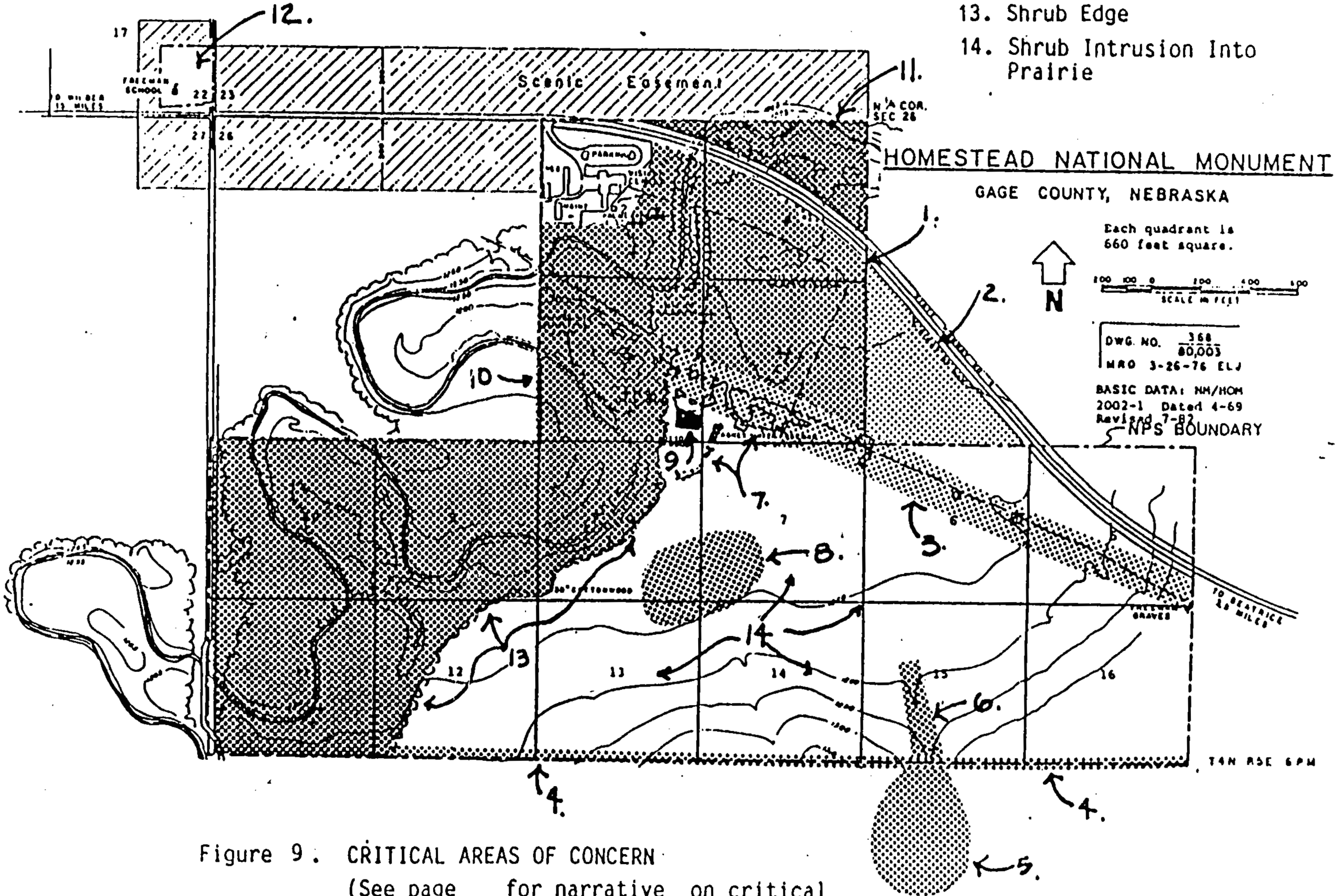

Figure 9. CRITICAL AREAS OF CONCERN
(See page for narrative on critical areas of concern.)

HNMA is one of the oldest ongoing attempts at restoring prairie habitats on man-altered landscapes. The only other nearly contemporaneous example is the restoration of the Curtis Prairie in Madison, Wisconsin in the 1930's. The Curtis Prairie has probably benefited from starting with a less disturbed site. It also benefited from close work with Dr. Curtis and his graduate students at the University of Wisconsin.

MANAGEMENT OBJECTIVES PROVIDED BY HNMA AND INVESTIGATORS' RESPONSES

HNMA Long-Term Goal

To restore the 100 acre prairie at HNMA to the approximate appearance and percentage species composition representative of the 1850-60 era.

Investigators' Response

The primary long-term objective to restore the HNMA prairie to its percentage species composition of the 1850-1860 era is a laudable and measurable objective. However, the specific original percentage species composition is not known, and it can only be approximated from other sources. In light of this problem, it is suggested that the approximation published in the <u>North American Prairie</u> (Weaver 1954) be used. These provide rough targets for restoration of specific management units.

Table 1. Percentage composition of the vegetation and frequency of occurrence of each of twelve most important grasses in lowland (155 m^2) and upland (180 m^2) prairie (adapted from Weaver 1954). Symbol * indicates presence at HNMA.

Species	Lowland Prairie Comp.	Lowland Prairie Freq.	Upland Prairie Comp.	Upland Prairie Freq.
	%			
Little bluestem *Schizachyrium scoparium**	2.0	19.0	55.0	98.0
Big bluestem *Andropogon gerardii**	78.0	100.0	24.8	99.0
Kentucky bluegrass (exotic) *Poa pratensis**	8.8	88.0	4.7	80.0
Porcupinegrass *Stipa spartea**	1.9	31.0	2.5	40.0
Prairie dropseed *Sporobolus heterolepis**	0.1	1.0	2.7	20.0
Indiangrass *Sorghastrum nutans**	1.9	37.0	1.8	51.0
Sideoats grama *Bouteloua curtipendula**	0.1	7.0	0.6	32.0
Panic grasses *Dichanthelium spp.**	0.3	28.0	0.4	36.0
Prairie junegrass *Koeleria pyramidata**	0.1	10.0	0.6	34.0
Canada wildrye *Elymus canadensis**	0.1	12.0	trace	4.0
Switchgrass *Panicum virgatum**	1.7	22.0	1.3	14.0
Prairie cordgrass *Spartina pectinata**	0.4	12.0	0.0	0.0
Forbs	3.6	74.0	4.1	90.0

For each prairie studied, Weaver made a complete list of forbs. After careful observation, each species was then placed into one of five groups, depending upon its importance. Those that occurred in great abundance and were of considerable importance throughout a prairie were designated as the society of the first class. Usually only 6 to 8 species in any prairie held such a high rank. These forbs were widely but not necessarily continuously distributed throughout the prairie. Other species which were of only slightly less importance were designated as a society of the second class. Others occurred in several places, but they were not common. They formed only a small part of the plant cover because they were infrequent, and they were placed in the fourth class. Certain species were so rare that they were observed only once or a few times. These were placed in the fifth class.

Table 2. Most important species of forbs in lowland prairies, arranged in order of decreasing importance. The first number indicates the percentage of prairies in which the species occurred in first, second, or third rank. The second number indicates percentage in the fourth or fifth rank (adapted from Weaver 1954). Symbol * indicates presence at HNMA.

Species	Classes 1, 2, & 3	Classes 4 & 5
	---------------%	---------------
Catchweed bedstraw Galium aparine*	70	4
Wild strawberry Fragaria virginiana*	52	20
Fringed loosestrife Lysimachia ciliata	74	26

Willow aster *Aster praealtus*	69	22
Canada anemone *Anemone canadensis*	50	13
Canada goldenrod *Solidago canadensis* *	72	14
Compassplant *Silphium laciniatum*	51	15
Prairie phlox *Phlox pilosa*	40	4
Wholeleaf rosinweed *Silphium integrifolium* *	41	26
Sawtooth sunflower *Helianthus grosseserratus*	54	28
Thickspike gayfeather *Liatris pycnostachya*	40	16
Smooth scouringrush *Equisetum laevigatum*	46	17
Golden alexanders *Zizia aurea*	35	14
American germander *Teucrium canadense* *	52	31
Prairie dogbane *Apocynum sibiricum* *	36	46
Meadow violet *Viola pratincola*	31	29
American licorice *Glycyrrhiza lepidota* *	43	14
Mountain-mints *Pycnanthemum spp.*	18	2
Waterhemlock *Cicuta maculata*	30	32
Culversroot *Veronicastrum virginicum*	33	2
Whorled milkweed *Asclepias verticillata* *	32	45

Smooth milkweed Asclepias sullivantii	24	38
Field horsetail Equisetum arvense	16	16
Purple loosestrife Lythrum salicaria	22	14
Annual fleabane Erigeron annuus	18	10
Western ironweed Vernonia fasciculata*	31	35
Jerusalem artichoke Helianthus tuberosus	19	18
Swamp milkweed Asclepias incarnata	11	25
Hypoxis Hypoxis hirsuta	trace	trace
Rough heliopsis Heliopsis helianthoides	22	36
Purple meadowrue Thalictrum dasycarpum	13	31
Swamp smartweed Polygonum coccineum	27	22
Black-eyedsusan Rudbeckia hirta*	24	8
Grayhead prairieconeflower Ratibida pinnata*	14	9
Golden groundsel Senecio pseudaureus	11	5
American bugleweed Lycopus americanus	14	21
Cup rosinweed Silphium perfoliatum	12	25
Inland ironweed Vernonia baldwini	24	26

Less important lowland species:

Clammy groundcherry (Physalis heterophylla)
Illinois tickclover (Desmodium illinoense)*
Fleabane (Erigeron philadelphicus)
Plantainleaf pussytoes (Antennaria plantaginifolia)
Palespike lobelia (Lobelia spicata)
Lanceleaf groundcherry (Physalis virginiana)*
Canada onion (Allium canadense)
Canada milkvetch (Astragalus canadensis)*
Sneezeweed (Helenium autumnale)
Southern hogpeanut (Amphicarpa bracteata
Common woodsorrel (Oxalis stricta)*
Gauras (Gaura spp.)*
Poisonivy (Rhus radicans)
Violet woodsorrel (Oxalis violaceae)*
Maxmilian sunflower (Helianthus maximiliani)
Cudweed sagewort (Artemisia ludoviciana)*
Wavyleaf thistle (Circium undulatum)
Marsh vetch (Lathyrus palustris)
Tuberous indianplantain (Cacalia tuberosa)

Table 3. Most important species of forbs in upland prairies, arranged in order of decreasing importance. The first number indicates percentage of prairies in which the species occurred in the first, second, or third rank. The second number indicates percentage in the fourth or fifth rank (adapted from Weaver 1954). Symbol * indicates presence at HNMA.

Species	Classes 1, 2, & 3	Classes 4 & 5
	%	
Leadplant Amorpha canescens*	87	6
Stiff sunflower Helianthus rigidus*	80	7
Heath aster Aster ericoides*	80	5
Field pussytoes Antennaria neglecta*	72	6
Daisy fleabane Erigeron strigosus*	76	9

Missouri goldenrod Solidago missouriensis*	64	12
Silverleaf psoralea Psoralea argophylla*	56	18
Prairieclovers Petalostemum spp.*	52	22
Pale echinacea Echinacea pallida*	40	26
Flowering spurge Euphorbia corollata	33	7
Stiff goldenrod Solidago rigida*	48	26
Groundplum milkvetch Astragalus crassicarpus*	36	21
Rough gayfeather Liatris aspera	39	23
Arkansas rose Rosa arkansana*	48	26
Finger coreopsis Coreopsis palmata	34	3
False boneset Kuhnia eupatorioides*	37	41
Slimflower scurfpea Psoralea tenuiflora*	22	16
Prairie blue-eyedgrass Sisyrinchium campestre*	40	11
Inland ceanothus Ceanothus ovatus	24	16
Dotted gayfeather Liatris punctata*	23	25
Tickclovers Desmodium spp.*	29	29
Blue aster Aster laevis	17	7
Cudweed sagewort Artemisia ludoviciana*	36	34

Roundhead lespedeza Lespedeza capitata*	28	27
Catclaw sensitivebriar Schrankia nuttallii	10	5
Showywand goldenrod Solidago speciosa	20	28
Azure aster Aster azureus	7	6
Grooved flax Linum sulcatum*	29	25
Western yarrow Achillea millefolium*	16	35
Prairie ragwort Senecio plattensis*	15	11
Atlantic wildindigo Baptisia leucantha*	12	22
Plains wildindigo Baptisia leucophaea*	19	27
Pitchers sage Salvia picheri*	9	16

Less important upland species:

Upright prairieconeflower (Ratibida columnifera)*
Lambert locoweed (Oxytropis lambertii)
Early lousewort (Pedicularis canadensis)
Rattlesnake master (Eryngium yuccifolium)
Upland willow (Salix humilis)
White milkwort (Polygala albda)
Candle anemone (Anemone cylindrica)
Blood milkwort (Polygala sanguinea)
Bastard toadflax (Comandra richardsiana)
Swamp lousewort (Pedicularis lanceolata)
Scaly gayfeather (Liatris glabarata)
Pink poppymallow (Callirhoe alcaeoides)*
Fringeleaf ruellia (Ruellia humilis)
Tall cinquefoil (Potentilla arguta)*
Prairie violet (Viola pedatifida)*
Lanceleaf groundcherry (Physalis virginiana)*.
Grassleaf goldenrod (Solidago graminifolia)
Cleft gromwell (Lithospermum incisum)*
Woolly plantain (Plantago patagonica)*

HNMA Short-Term Goals

1. To establish workable prairie management units and recommend alternative measures to reach the long-term objective.

Investigators' Response

The HNMA prairie should be divided into two main management units, the lowland area below contour 1270 and the upland area above that contour and including the Freeman School (Figure 8). Within these two broad units should be subsections based on environmental conditions. For example, the area generally located at the intersections of Quadrats 7, 8, 13, and 14 (Critical Area 8, Figure 9) could be considered as a subsection of the lowland (for a listing and narrative on critical areas see pages 17 and 77). The subsection is more moist and, thus, has potential for different plant species. As well, the exposed gravel slopes in the upland could be considered a subsection of the uplands because of the restrictive soil conditions and gully erosion (Critical Area 6, Figure 9). These gravel slopes, however, have been extensively managed for the last 45 years and are approaching a natural prairie species composition. New gullies should be sodded with native upland sod. Off-site dams should be checked for control. At the Freeman School, native prairie and areas adjacent to the buildings should be mowed to control weedy species and for fire hazard reduction. The smooth bromegrass border that now threatens the remnant prairie should be treated with an herbicide in the spring before active growth of the native plants (Critical Area 12, Figure 9). Some areas may require revegetation with native prairie species.

2. To research and recommend a cyclic prescribed fire program to deal with the prairie as a whole and for specific management units.

Investigators´ Response

Prescribed burning should be part of an integrated program of management. Cyclic burning is generally beneficial, but it cannot be recommended as a blanket management tool. Fire must be site and condition sensitive. For example, the steep, gravelly slopes of Quadrats 14, 15, and 16 are less productive and likely to have less need for burning. Conversely, the lowland area will have a tendency for thatch buildup and therefore will be more prone to wild fire because of higher levels of human activities and it proximities to trails and roads. Overall production of organic matter is related to soil moisture and species composition. Time of burning should be at various times throughout the year so as to not favor or retard seasonal plants.

3. To provide alternatives for dealing with the encroachment and control of exotic species, including methods, timing, etc.

Investigators´ Response

Species exotic to the area are most apparent in the lowland areas which have experienced the most frequent and greatest disturbance. Kentucky bluegrass, musk thistle, smooth bromegrass, and woody species are troublesome plants. Smooth bromegrass must be supplanted by a stable prairie planting. If repeated mowing is to continue at the Freeman School, the mow line should be moved north about 20 feet to help to slow the encroachment of smooth bromegrass into the native prairie.

4. To provide alternatives for removal or control of woody species encroaching onto the prairie. Include alternatives for fire resistant and suckering species.

Investigators´ Response

The existing State Highway 4 right-of-way (Critical Area 3, Figure 9) should be managed in conjunction with the Nebraska Department of Roads, and special attention should be given to the removal of eastern redcedars over the current minimum allowable diameter. Woody shrubs have always been a component of the prairie. Selected thickets should be allowed to remain and should be managed by combinations of hand-digging, mowing, burning, and herbicides.

Removal of all trees in both the upland and lowland prairies is a desirable long-term goal. These large trees are noted as Critical Area 7, Figure 9. They are visually intrusive into the prairie vista and shade of surrounding prairie species. However, about six of the largest trees have some historical tie to the Agnes Suiter Freeman cabin. They should be left in place but not replanted when they die. Specific methods and critical areas are addressed in other sections of this report.

5. To recommend native grass species that are shade tolerant that may be used where trees must be protected, such as near the osage-orange along the south boundary.

Investigators´ Response

The hedgerow area should be managed in two different ways to provide a view of a 1870 hedgerow and the unmanaged hedgerows common today. This comparison will provide a valuable interpretative tool. Mowed smooth bromegrass and Kentucky bluegrass in the shade of a thinned hedge will hold the soil and serve as a fire barrier.

6. To research and provide recommendations for the treatment of potentially undesirable native species such as sunflowers and smartweeds. Do they belong, will they spread, and what percentage is acceptable?

Investigators' Response

Wet lowland species should be planted to supplant the weeds in the wetter portions of the lowland prairie. The reader should see the section entitled "Intensive Restoration" for species and techniques to supplant weeds and the section entitled "Critical Areas of Concern" for discussion of the problem.

Native annuals were a part of the prairie which filled in disturbed areas such as on pocket gopher mounds. Disturbed sites may be areas where desirable forbs can also start. In the future, HNMA may wish to consider introducing additional natural prairie rodents.

7. To assess potential damage caused by mechanical equipment and vehicle use on the prairie and recommend alternatives to minimize impact.

Investigators' Response

Vehicle impact is damaging only if it is frequent or on wet soils.

8. To insure recommendation are consistent with preservation of archeological/cultural resources.

Investigators' Response

The hedgerow is a cultural resource and should be managed for interpretation (see 4 and 5, above). The presence of trees on the prairie is intrusive. They negatively impact the prairie species and the visitors' view and concept of prairie. The location, configuration, and make up of the native plant garden needs reconsideration. The cash crop interpretation area provides a continual disturbance and potential weed source. It could be a more effective display in a closer proximity to the other interpretative features near the headquarters. Removal of the old State Highway 4 right-of-way grade would blend the area with the natural contour. However, since its alignment follows the old St. Joseph to Fort Kearny stage route, it should be kept. Shrub shrub pockets which produce a linear man-made form should be removed (Critical Area 3, Figure 9).

9. To establish on-going monitoring procedures to determine if goals are being met.

Investigators' Response

Species composition should be monitored on a regular basis, every two to three years, to guide the prairie toward the major objective. Accumulation of organic matter on the soil surface should be monitored, because large amounts will negatively impact the prairie plants. Methods and schedules will be discussed later in this report.

10. To recommend locations and techniques for screening adjacent nonhistoric developments and providing shaded areas for visitor rest and comfort consistent with prairie restoration goals.

Investigators' Response

The influence of State Highway 4 and the adjacent residential development is particularly distracting for the visitor's experience of the HNMA prairie and its interpretive significance. It is difficult to recommend specific screening uses in a vegetation management plan, however the triangular right-of-way could provide some buffering if a plan was cooperatively designed and managed by HNMA and the State Department of Roads. As well, a portion of Quadrat 1 (see Figure 8) could be converted to woodland north of the highway with a narrow strip of woodland south of the highway. In addition, a band of shrubs edging the woodland on the south would help provide a dense twiggy screen during the winter months. This entails managing a shrub edge in addition to that edge that occurs along the eastern edge of the woodland. Subsequently, woody plants south of State Highway 4 make it imperative to reorient the visitor's initial view of the prairie from the east to the southeast. Within the prairie, managed shrub thickets could supply shade to visitors on the trail (see 4, above and the section entitled "Areas of Critical Concern").

11. To recommend alternatives for restoration of weedy areas to native species composition.

Investigators' Response

The weedy lowlands should be restored. See the comprehensive discussion in later sections of this report entitled "Intensive Prairie Restoration" and "Areas of Critical Concern."

12. To recommend reintroduction of species not currently present but consistent with the long-term goal.

Investigators' Response

Species diversity should be increased. This fact is apparent when one compares Tables 2 and 3 with the list of species collected at HNMA. Methods of introduction are discussed in the sections on "General Review of Management Options" and "Intensive Prairie Restoration."

13. To determine if areas are present that are so disturbed by cultivation that it would be futile to attempt to restore prairie on those sites.

Investigators' Response

No sites exist at HNMA on which restoration would be impossible. The weedy lowland will be a challenge. Problems and methods are discussed in sections entitled "Intensive Prairie Restoration" and "Areas of Critical Concern." Removal of the old State Highway 4 grade will create an exposed area that will need attention. Following the removal of trees from prairie areas, grasses should naturally move into the formerly shaded places.

14. To assess the impact of "cash crop" interpretive garden on prairie restoration and recommend the future management of the area.

Investigators´ Response

The cash crop area is addressed under Number 9, above (also see "Areas of Critical Concern").

SAMPLING RESULTS

Species Composition

Each area of Homestead National Monument of America was sampled with a modified step-point on five different dates. Spring sampling occurred in June of 1983 and 1984. Fall sampling was conducted during October of 1982, 1983, and 1984. About 8 acres of the lowland and upland prairies burned in the spring of 1982. The path of the fire was visually evident in the vegetation in 1982. A decision was made to sample the burned area separately from the nonburned portions of the prairie. A prescribed fire was applied to all of the prairie in the spring of 1983, but those areas burned in 1982 were sampled separately to the end of the project.

Caution must be exercised in the interpretation of species composition data. Data from the two spring samplings may be compared, and data from fall samplings may be compared. Data between seasons should not be compared. For example, weedy annuals such as foxtails or crabgrass are seasonal. Small amounts of a species may have been present during the spring sampling, and they may have become major components by the time of the fall sampling. These large amounts of seasonal species appear to cause a decrease in perennial species when, in fact, they occupy bare spaces between perennials. Basal cover of the perennials was not influenced, although species composition was greatly influenced.

Prairie species are dynamic. Changes in composition constantly occur in response to weather, management, and many other factors.

Minor fluctuations (2 to 3%) in major species are natural and may be the reflection of changes in other species. Consistent trends are important. For example, change in species composition from 2% to 1% and then to zero over a three-year period is probably a real change. Like-wise, a trend from zero to a trace and then to 1 or 2% over a three-year period may indicate a response to current management. It may be an invasion of a weedy species, or, hopefully, an increase of a desirable prairie species.

Upland Prairies Burned in 1982 and 1983

Big bluestem, indiangrass, and little bluestem were the dominant species on the prairie (Table 4). These plants, as well as switchgrass, remained stable throughout the period. Small gains in prairie dropseed and stiff sunflower were recorded. Large increases in Kentucky bluegrass and goldenrods occurred. Smooth bromegrass also increased. These increases could be due to the unusually wet, cool springs in 1983 and 1984.

Upland Prairies Burned in 1983

This area includes some of the drier upland prairies in the southeast portion of the park. Big bluestem is the most abundant species, but its composition is lower than on the sites with more favorable moisture (Table 5). Percentage composition of indiangrass is nearly as large as that of big bluestem. Larger percentages of little bluestem, sideoats grama, and switchgrass are found on this area. Kentucky bluegrass and goldenrods have increased, and smooth bromegrass remains a potential problem.

Table 4. Species composition (%) of the primary plants of the upland prairie burned in 1982 and 1983.

Common name	species composition				
	spring sampling		fall sampling		
	6/83	6/84	10/82	10/83	10/84
	%				
Big bluestem	44.98	43.62	45.45	46.93	48.50
Indiangrass	19.19	20.13	22.72	21.96	20.17
Little bluestem	9.04	10.04	13.64	13.01	12.91
Switchgrass	5.21	5.62	4.55	4.51	4.92
Prairie dropseed	0.04	0.07	0.61	0.81	3.01
Kentucky bluegrass	0.00	1.31	0.00	0.61	5.73
Smooth Bromegrass	0.05	2.19	0.00	0.00	1.13
Goldenrods	6.41	9.72	0.91	3.18	7.52
Stiff sunflower	3.12	3.14	0.62	0.73	1.50
Plant cover	7.16	8.32	10.09	10.56	10.42
Litter cover	5.91	59.31	76.27	23.41	71.09
Bare ground	86.93	32.37	13.64	66.03	18.49

Table 5. Species composition (%) of the primary plants of the upland prairie burned in 1983.

Common name	spring sampling		fall sampling		
	6/83	6/84	10/82	10/83	10/84
	%				
Big bluestem	25.43	24.12	24.68	26.12	23.17
Indiangrass	19.82	19.61	21.32	21.95	20.05
Little bluestem	12.12	13.14	19.43	19.51	17.12
Sideoats grama	2.11	2.91	7.11	6.57	7.13
Switchgrass	10.10	9.82	12.80	13.70	13.02
Prairie dropseed	5.18	4.19	2.84	3.16	3.12
Kentucky bluegrass	0.00	1.04	0.00	0.71	2.13
Smooth Bromegrass	0.19	0.23	3.31	1.12	2.62
Goldenrods	8.16	6.71	2.47	5.16	8.05
Stiff sunflower	4.89	4.19	1.42	1.71	1.44
Plant cover	7.29	8.04	10.83	10.72	10.06
Litter cover	6.13	53.51	87.75	22.91	70.13
Bare ground	86.58	38.45	1.42	66.37	19.81

Lowland Prairie Burned in 1982 and 1983

As in original lowland prairies, big bluestem comprises over 50% of the vegetation (Table 6). It is followed, in proper order, by indiangrass, switchgrass, and little bluestem. Percentage of goldenrods is high, while Kentucky bluegrass and smooth bromegrass are increasing.

Lowland Prairie Burned in 1983

Percentages of the major species are similar to those in the Lowland Prairie burned in both 1982 and 1983 (Table 7). Percentage little bluestem is lower and switchgrass is higher, but this difference is not due to the burning history. Goldenrods are also high in this area. Kentucky bluegrass is very high. These species, along with smooth bromegrass, require immediate attention.

Weedy Lowland

The species composition of the weedy lowland shows a relatively small amount of desirable prairie plants (Table 8). The numbers illustrate the fact that the rate of succession would be very slow. Without proper management, unsightly weeds will continue to be a problem.

Mowed Area Around the Freeman School

The major species in the mowed area is Kentucky bluegrass (Table 9). Crabgrass increases by late summer. Buffalograss is present in patches. The species list includes many common lawn weeds.

Table 6. Species composition (%) of the primary plants of the lowland prairie burned in 1982 and 1983.

Common name	species composition: spring sampling 6/83	6/84	fall sampling 10/82	10/83	10/84
	%				
Big bluestem	56.14	55.14	58.26	59.16	57.61
Indiangrass	14.10	13.91	13.70	13.73	12.42
Little bluestem	3.96	3.40	3.42	2.98	2.41
Switchgrass	8.12	7.31	7.53	8.01	7.05
Eastern gamagrass	3.21	2.14	1.37	0.14	0.29
Smooth bromegrass	1.22	2.04	1.37	0.96	1.96
Kentucky bluegrass	0.09	2.16	0.07	0.11	1.31
Ironweed	0.00	0.00	0.19	0.00	0.14
Goldenrod	6.25	8.01	4.11	6.71	8.21
Plant cover	10.62	10.14	13.02	14.14	13.89
Litter cover	7.78	56.12	67.12	20.62	69.14
Bare ground	81.60	33.74	19.86	65.24	16.97

Table 7. Species composition (%) of the primary plants of the lowland prairie burned in 1983.

Common name	species composition: spring sampling 6/83	6/84	fall sampling 10/82	10/83	10/84
	%				
Big bluestem	47.47	48.41	44.67	48.11	48.20
Indiangrass	13.04	12.07	12.69	12.92	10.18
Little bluestem	8.91	7.04	8.12	8.41	6.92
Switchgrass	6.51	4.92	5.58	6.19	4.13
Smooth bromegrass	2.01	3.17	7.61	3.16	3.86
Kentucky bluegrass	0.14	3.15	3.05	0.91	7.71
Dogwood	0.08	0.16	1.52	0.09	0.10
Coralberry	0.05	0.09	1.02	0.04	0.06
Ironweed	0.00	0.00	1.02	0.00	0.05
Goldenrod	9.06	10.17	6.60	8.75	8.82
Plant cover	13.18	14.09	18.27	14.16	15.05
Litter cover	3.80	50.62	81.22	21.81	68.40
Bare ground	83.02	35.29	0.51	64.03	16.55

Table 8. Species composition of the weedy lowland.

Common name	species composition				
	spring sampling		fall sampling		
	6/83	6/84*	10/82	10/83	10/84*
	%				
Big bluestem	8.19	10.41	7.94	2.04	6.16
Indiangrass	25.26	26.42	11.18	8.16	9.71
Switchgrass	25.01	30.71	10.13	6.12	9.23
Smooth bromegrass	2.98	3.64	4.72	4.08	3.91
Goldenrods	14.71	15.92	3.96	2.04	5.62
Foxtails	0.41	1.04	42.12	48.99	40.40
Mare's tail	12.13	6.12	14.65	18.37	18.07
Nettle	0.04	0.00	5.13	6.12	4.19
Annual bromes	11.27	5.74	0.17	0.00	0.00
Sunflower	0.00	0.00	0.00	0.00	2.71
Plant cover	7.21	8.04	7.16	12.24	12.91
Litter cover	9.17	82.13	8.35	71.43	80.77
Bare ground	83.62	9.83	84.49	16.33	6.32

* 1984 data cannot be directly compared with data from previous years. The main weedy area was mowed in 1984. Data from 1984 were collected in the remaining weedy area around the mowed area.

Table 9. Species composition (%) of the mowed area around the Freeman School.

Common name	species composition				
	spring sampling		fall sampling		
	6/83	6/84	10/82	10/83	10/84
	%				
Switchgrass	1.3	1.4	0.8	2.6	2.4
Kentucky bluegrass	61.7	60.4	29.8	33.4	37.9
Smooth bromegrass	2.9	4.8	1.5	2.3	6.7
Crabgrass	1.4	0.0	37.4	26.4	21.3
Buffalograss	22.6	20.7	12.2	12.8	13.8
Sideoats grama	3.7	4.2	1.5	2.6	2.7
Foxtail	0.0	0.0	1.5	2.1	1.3
Stinkgrass	0.0	0.0	0.8	1.3	0.0
Sedge	2.8	3.5	2.3	2.5	1.9
Dandelion	3.6	5.0	2.3	5.9	9.8
Prostrate knotweed	0.0	0.0	9.9	8.1	2.2

Nonmowed Area Behind the Freeman School

Big bluestem is the dominant species, but it is being invaded on all sides by smooth bromegrass (Table 10). Immediate management action will be required to stop the invasion (see page 27). Many of the desirable prairie grasses and forbs can be found in this small area, but they are present in rather small quantities.

Range Condition as a Measure of Climax

Range condition can be used as a measure of climax vegetation. It is based on abundance and diversity. Productivity by species was estimated in representative areas in each unit. These data were then compared to tables, furnished by the Soil Conservation Service, containing the maximum allowable for each species on each site. The lowland prairies are located on a silty lowland range site while all other prairies within the park are located on a silty range site. A range condition of 100% indicates climax vegetation. It is important to note that range condition is based on diversity and productivity and not totally on species composition.

Upland Prairies Burned in 1982 and 1983

Range condition in these areas averaged 85%. Big bluestem, indiangrass, switchgrass, and little bluestem were the major contributors to the total. Range condition could be increased by increasing species diversity of the forbs and by increasing or adding grasses such as porcupinegrass, prairie dropseed, prairie junegrass, and sideoats grama.

Table 10. Species composition (%) of the nonmowed area around the Freeman School.

Common name	species composition: spring sampling 6/83	spring sampling 6/84	fall sampling 10/82	fall sampling 10/83	fall sampling 10/84
	%				
Big bluestem	61.0	53.2	54.7	60.7	51.6
Indiangrass	6.2	4.9	1.0	5.9	4.3
Little bluestem	2.1	1.3	1.0	2.0	1.6
Switchgrass	6.6	5.2	5.9	6.1	6.0
Kentucky bluegrass	0.0	2.1	0.0	0.0	1.2
Smooth bromegrass	21.3	31.4	35.3	23.4	33.9
Canada wildrye	2.8	1.9	1.0	1.9	1.4
Prairie cone flower	0.0	0.0	1.0	0.0	0.0

Upland Prairies Burned in 1983

The highest range condition, 90%, occurred in these areas. Burning in 1983 alone, as compared to burning in 1982 and 1983, is not responsible for the difference between 85 and 90%. The southeast 4 acres of the HNMA prairie contains the most diversity. This is reflected in the higher range condition.

Lowland Prairie Burned in 1982 and 1983

Range condition for this lowland prairie was 70%. All of the major grasses contribute to this total. Big bluestem is too abundant in relation to the other major grasses. Additional species of grasses should be added or increased, and forb diversity must be increased before range condition could be improved.

Lowland Prairie Burned in 1983

Range condition of the lowland prairie burned in 1983 was 65%. Overall, it is similar to the lowland prairie burned in both 1982 and 1983. Diversity of both forbs and grasses must be increased to increase condition.

Weedy Lowland

The area surrounding the tilled portion of this unit was sampled in 1984. The condition was only 20%. Small amounts of big bluestem, indiangrass, and swithchgrass were the main components of this small percentage.

Mowed Area Around the Freeman School

Range condition is probably not applicable to a continually mowed area. The few native species present combine to total 20% of climax vegetation. Switchgrass and sideoats grama were the primary species.

Nonmowed Area Behind the Freeman School

Range condition in this area was 65%. Big bluestem was the most abundant species. Lesser contributions toward the total cam from indiangrass and switchgrass. The relatively large amount of smooth bromegrass and the low diversity of forbs were the primary reasons for this level of condition.

PHOTO PLOTS

Black and white prints and color slides of Homestead National Monument of America were evaluated in 1982. HNMA personnel with the responsibility for photography described the process to the evaluators. It was concluded that the Homestead National Monument of America has started to collect a valuable historical resource management tool. Photo plot locations are shown in Figure 10 (arrows indicate direction of photographs taken to document visual quality ratings).

The following are recommendations for the ongoing photographic plot documentation:

A. Camera should frame the view as exactly as possible.

1. Enframing reference points should be noted and/or an inconspicuous stake or pin should be used under the camera. A lateral, overlapping photo or use of compass bearings may also help.

2. The camera, film, and lens should be the same for every photograph.

3. The time of year, sun angle, and light intensity should be a equal as possible. Generally, an overcast day will improve photographic detail and delete the problem of too much contrast.

4. Bracket exposures to assure the best exposure.

5. Since many of the views are panoramic, it is essential to have a small overlap on each side of the frame.

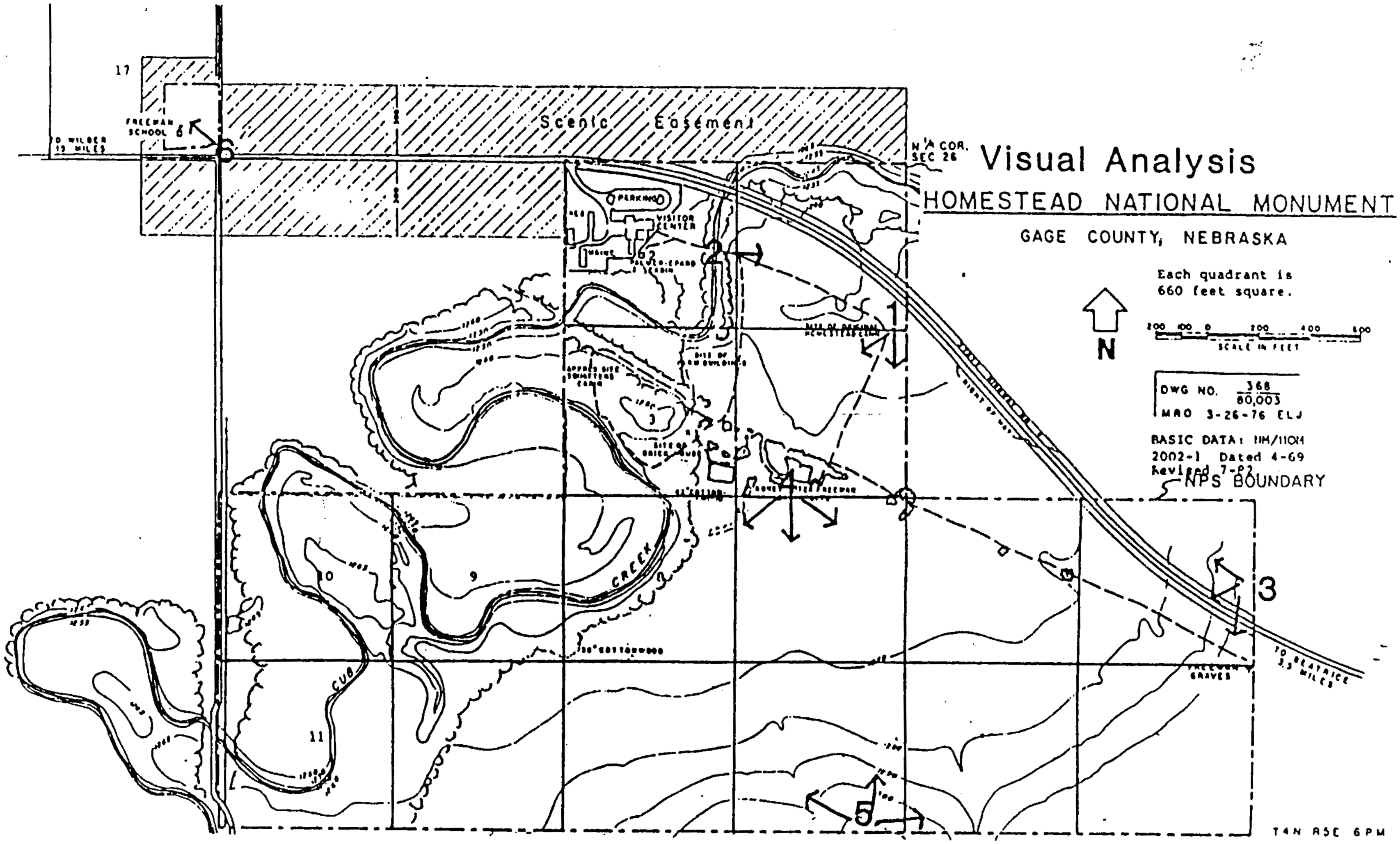

Figure 10. PHOTO PLOT LOCATIONS

6. Slow speed film should be used for black and white photos to reduce the grainy character of the prints.

7. Use of a tripod would maximize camera steadiness while keeping it on one point.

B. Inclusion of a rodman helps establish the scale of the scene in the photo.

C. Reinstate a photo plot at station 2. It is the critical first view of the prairie by the visitors.

D. Photos should be taken three times a year to coincide more closely with the phenology of the prairie. Dates of May 1, July 15, and October 1 are suggested.

E. Photo plots should be established on a five-year interval for several points in the wooded portion of the park. These should be in areas of higher visibility to the public (eg. view southeast from the west side of the park, from State Highway 4, and along the loop trail).

F. Photo plot documentation needs to be done after any major visual change or natural event (eg. after a prescribed burn or during a flood).

G. Additional procedures for consideration are covered in the attached United States Forest Service publication (Appendix II-1).

VISUAL QUALITY

Visual quality was rated in early November of 1983. These ratings were tied to the six existing photo plots, because the plots represent a good cross section of Homestead National Monument of America and are already documented with photographs. The visual quality ratings were considered along with species composition and the desired goals to determine specific vegetation management recommendations.

While specific plant related evaluations and measurements were objective and plot specific, the visual quality as perceived by the visitor must include the surrounding landscape context. The visual quality ratings were made on a scale of 10 (high quality) to 1 (low quality) and were subject to interpretation by the observer with the descriptive guidelines for each category. The ratings taken together can be reliably compared with each other, but are not valid when compared with other sites. That is, the ratings only rank with visual quality of sites (photo plots) within the Homestead National Monument of America.

The visual quality ratings are based on three design and visual principles: (1) Vividness-the memorability and uniqueness of what is seen; (2) Unity-the repetition of basic design elements such as color, form, texture and space; and (3) Intactness-undisturbed and unchanged. "Undisturbed prairie" was selected as the most intact state (Appendix II-2). However, because Homestead National Monument of America is both a preserve of our natural heritage and our historical and cultural heritage, certain landscape elements are potentially in conflict with regard to intactness.

The principles of vividness, unity, and intactness were rated with respect to two major categories: (1) Vegetation and (2) Features found in the landscape. Vegetation quality and landscape features found in summaries of the six photo plots are shown in Table 11.

Photo Plot 1 (Figures 10 and 11) is located on the east edge of the restored lowland prairie. View orientation is essentially south, except when approaching the site from the south or west. This site receives a relatively high rating except for the intrusion of State Highway 4 and housing from the northeast. Hay bales create unnatural forms along the south skyline.

Photo Plot 2 is a visitor's first view of the prairie. The vegetation is of a lower quality, but most critically the view is short, poorly enclosed, and heavily intruded upon by State Highway 4 and housing to the east. The color of the foot-bridge should be more subdued. Perhaps it should be painted a neutral brown or gray. Restoration of the Cub Creek bank will need special attention to reunify and strengthen the transition form forest to prairie. Perhaps a transition can occur through a shrub edge.

Photo Plot 3, as located, does not relate to a pedestrian view. But, it does capture the "view from the road" as seen by many travelers along Highway 4. For visitors approaching Homestead National Monument of America from the east, this photo point represents their first and most vital impression. Visible are strong manmade forms such as the old Highway 4 right-of-way, osage-orange hedge, the new Highway 4 right-of-way, and the line of redcedar the northeast. Each detracts from the naturalness of the view, however the old Highway 4 right-of-way is the most intrusive as it bisects the restored prairie.

Table 11. Rank and scale of the six photo plots[1] for vegetation and landscape feature quality.

Rank / Scale	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6
Vegetation	3	5	6	1	2	4
(40 max.)	20	18	17	24	22	19
Feature	3	4	2	1	5	6
(50 max.)	17	15	20	31	14	8

[1]Individual rating sheets are in Appendix II-3.

Photo Plot 4 (Figures 10 and 12) rates the highest in both vegetation and landscape categories because of the long, panoramic views, less visible evidence of man's intrusion, and strong spatial enclosure. Photo Plot 5 rates high in the vegetational aspects because of the complex, although visually unified, native plant community. However, the view off site to the north has strong manmade intrusions (Figures 10 and 13). In particular, these intrusions include the fertilizer plant, grain elevator, and housing. The view west from Photo Plot 5 is more natural and defined by the forest edge along Cub Creek.

Photo Plot 6, the Freeman School, receives lower ratings because of short views and the overwhelming dominance of manmade forms such as Highway 4, the fence enclosure, and row crops. Of all the photo plots,

Figure 11. View south from photo plot 1 looking across the east edge of Quadrat 4 of the lowland prairie. Note the effect of the April, 1983 prescribed burn on the woody species. This June photograph shows excellent recovery by the prairie species. Note the intrusion of trees near the old Agnes Suiter Freeman cabin site and the strong linear feature of the hedgerow. Also notice the small depression in the middle which is wetter and contains different species (Photo in June, 1983 byn R. K. Sutton).

Figure 12. View south, southeast from photo plot 4 across Quadrats 7, 14, and 15. Note the strong linear feature of the hedgerow, natural round forms of the shrub communities, and undisturbed views in the distance (Photo in June, 1983 by R. K. Sutton).

Figure 13. View north, northwest from photo plots across Quadrats 14, 1, 4, 7, and 8 toward photo plot 4. Note the visual intrusion of the industrial development and housing, and the strong linear feature provided by the old State Highway right-of-way. Compare this feature with Figure 6 (Photo in June, 1983 by R. K. Sutton).

this one has the strongest tie to cultural history. Therefore, rating it as to "naturalness" becomes somewhat arbitrary.

In summary, visual quality ratings are subjective evaluations of what visitors may see. What one sees in a visit to Homestead National Monument of America is strongly influenced by off-site visual context. These evaluations were taken into consideration along with other factors in prescribing an overall vegetation management plan.

GENERAL REVIEW OF MANAGEMENT OPTIONS

Seeding

Artificial seeding has been used to reestablish grasslands for many years (Forsling and Dayton 1931). In most cases, the purpose has been to produce high yielding and high quality forage for domestic livestock (Bleak and Hull 1958, Eckert and Evans 1967, Dowling et al. 1971, Laycock 1982). Establishment of prairie species for aesthetic or other purposes has been a more recent objective of seeding (Schramm 1976). Although, reestablishment of prairie species at Homestead National Monument of America dates back to the 1930's, and it has been accomplished by both seeding and sodding.

Seedbed Preparation

The objective of seedbed preparation is to provide an environment which enhances seedling emergence and establishment. Good seed to soil contact, control of competing vegetation, and conservation of soil moisture must be accomplished. The probability of stand failure increases if any one of these considerations are neglected.

Where soil erodibility, due either to wind or water, is a major concern, clean tilled seedbeds are not recommended (Barnes et al. 1952). However, on flat topography in eastern Nebraska, erosion is not a serious problem.

Loose, soft seedbeds are undesirable because of difficulty in seed placement and poor moisture holding capacity (Vallentine 1971). Use of cultipacker equipment before planting has been shown to increase seedling numbers (McGinnies 1962).

Seedbeds must be free from weeds (Sumner and Love 1961, Herbel et al. 1973). Seeding failures have commonly been attributed to competition from weeds (Plummer et al. 1955). In one experiment, seedlings emerged from both prepared and unprepared seedbeds. But, all of the plants seeded in un prepared seedbeds died (Hull 1963). When reseeding weedy pastures with warm season grasses in eastern Nebraska, plowing was a better seedbed preparation than discing (Cox and McCarty 1958). In the same study, two and one-half times as many seedlings established where weeds were controlled as compared to plots receiving no control measures.

Herbicides have been used successfully for control of competing species in sod seedings in eastern Nebraska (Samson and Moser 1982). However, herbicides may limit the species that can be seeded in an area, and the cost can be high.

A stubble mulch method recommended by the Soil Conservation Service plants sorghum the year prior to when the grasses will be seeded. The sorghum is planted late enough to allow no seed production, or if seed heads are formed the grain is harvested. Forage sorghum could also be planted, but it must be harvested leaving a stubble of 18 to 24 inches. The following spring the prairie species are drilled directly into the stubble.

<u>Time of Planting</u>

Time of planting is critical for germination. Seed should be planted when temperature conditions are adequate for germination, soil is moist to a depth of 24 inches, and just before a period with a high probability of prolonged precipitation and optimal growing temperatures (Fults 1944, Stewart 1949)). The proper time of seeding warm season prairie species in eastern Nebraska is during the month of May. Delaying until late May will allow weedy species to germinate and be controlled by tillage. The probability of adequate precipitation decreases if planting is delayed until June.

A second potential seeding period is during the dormant season from late fall through winter. The advantage of seeding during this period is related to seed dormancy. Some prairie species require over wintering to break dormancy. Therefore, planting in the fall will furnish the required conditions to enable the seeds to germinate normally in the spring. The largest problem associated with this planting period is weed competition. This method does not allow for spring tillage to eliminate the flush of winter and spring annuals.

Seeding Mixtures and Rates

The prime objective of prairie restoration is to create plant communities similar to those in the original climax vegetation. Therefore, extreme care must be exercised in designing seeding mixtures. It is not only necessary to know the balance of species required, but it is also necessary to know which species are easy to establish and which are difficult to establish. For example, switchgrass is one of the main components of a prairie. But, a very small amount of switchgrass seed should be included in a mixture, because it readily establishes. It is generally best to plant larger portions of the more difficult to establish plants and smaller portions of the easy to establish plants. Over time, properly balance prairie communities will evolve.

Seeds may either be purchased from commercial dealers (Appendix III) or harvested from native stands. Commercial seeds are relatively inexpensive and generally do not have a dormancy problem. Most commercial grass seeds have been selected or bred to produce high forage yields for domestic livestock. In most instances, these plants will be uniform in height and appearance. This may not be desirable. Harvested seeds may contain more natural variation than commercial products, and genetic resources can be conserved through use of locally collected seed. Most species of grasses are commercially available. Few forbs are commercially produced. A number of forbs from wild harvest are available, but the species are limited and generally expensive.

Seeding Methods

Broadcasting seed is the least expensive method of seeding, but broadcast seed must be covered either artificially or naturally to result in a successful stand (Stewart 1949, Killough 1950). Artificially mulching with dead plant materials (Moldenhauer 1959) or asphalt emulsion (Bement et al. 1961), harrowing (During and Cullen 1962), cultipacking (Watkin and Winch 1974), and running livestock over the land (Forsling and Dayton 1931, Watkin and Winch 1974, Laycock 1982) were several methods that have been used to cover seed after broadcasting.

Drilling is the most successful and widely used methods of planting prairie seeds (Hyder et al. 1955, Eckert and Evans 1967, Nelson et al. 1970). Drills with packer wheels are designed to assure a good seed to soil contact. Grass drills are also specially designed to handle fluffy seeds and to place seeds at the proper depth. Grain drills should not be used to plant prairie species.

Mulches

Mulches have been used to conserve soil moisture, reduce erosion, and to reduce weed competition. Some research has shown that mulch is especially beneficial to germination and establishment in low moisture areas (Anderson 1955, Army and Hudspeth 1959). The stubble mulch method as recommended by the Soil Conservation Service is commonly used in the Great Plains (Oldfather 1984). Mulches were generally unsuccessful in counteracting the effects of climate on seedings that failed due to erratic precipitation patterns (Launchbaugh 1966). Certain types and high rates of mulches have inhibited establishment by forming a physical barrier to emerging seedlings (Stubbendieck and McCully 1972). Costs of adding mulches to the soil surface after planting may be prohibitive.

Irrigation

Success or failure of seedings in the Great Plains has been directly attributed to variability of timing and quantity of precipitation (Hyder et al. 1955, Army and Hudspeth 1959). Irrigation can assure establishment if natural rainfall fails. Irrigation should not be necessary if the seedbed is moist at time of seeding and rainfall is near normal. Irrigation has been shown to also increase weedy species.

Post Emergence Management

Weed control will be the major post emergence management problem. Herbicides are available to control broadleaf weeds, but they cannot be used if forbs are included in the seeding mixture. Mowing is probably the best management tool for a new seeding. Weedy species will generally grow more rapidly than the seeded species. Therefore, mowing height should be set just above the height of the desirable seedlings. Three or four mowings may be necessary during the first growing season. One or two mowings may be required during the second growing season.

Forb Enrichment

Forbs are an important constituent of a prairie ecosystem because they contribute to aesthetic enhancement, aid in soil and water conservation, and provide a rich source of food cover, and nesting material for wildlife. Leguminous forbs, through the process of nitrogen fixation, promote the growth of all plants by increasing soil fertility.

Unfortunately, many native areas (due to improper cultural practices) and areas seeded to native vegetation lack the full range of plant species which should be found in a prairie ecosystem. Native grasses are the predominant vegetation in these areas, especially in seeded areas where forbs were not included at the time of seeding or failed to establish successfully with the grasses. This failure to establish may have been due to poor germination, inability to compete with grasses, and/or improper cultural practices.

Seed Selection and Acquisition

Species within prairie remnants near the area to be restored should be identified before the restoration process begins. Research into the historical species distribution of the area should be conducted.

Restoration implies reconstructing the original vegetation, and all attempts should be made to utilize local ecological races or ecotypes. It has been well-documented that ecotypes differ in a variety of ways including adaptive abilities, time of flowering, growth responses, and physical characteristics. Generally, seed should be collected within 100 miles of the area to be restored and from similar habitats. Species should be identified and marked when in bloom so that the plants can be located when the seeds have ripened.

Seed Storage

Seeds should be placed in unheated, dry storage and protected from insects and rodents. Native prairie seeds often need a cold, wet treatment in order to break dormancy and produce adequate germination during the first year. The moist chilling treatment may be accomplished by placing seeds into moist sand, peat moss, or vermiculite or by rolling them into a moist paper towel. The seeds and medium are then stored at temperatures between 32° and 41° for one to four months. Germination of about 75% of prairie forbs may be improved by such moist chilling. Seeds of about 50% of the prairie forbs can be treated with cold and no moisture. This eliminates the danger of premature germination. A few prairie seeds break dormancy when exposed to light, and these seeds will germinate best when planted near the surface of the soil. Seeds of about 15% of the species are not affected by moisture or chilling, and some are harmed by the process. A prairie propagation handbook such as the one by Rock (1977) should be consulted for the proper treatment for different species. However, there are many species for which no documented handling and treatments have been published.

Legume seeds, like those of the genus Baptisia, may need scarification as well as moist chilling. Scarification is a mechanical or acid treatment which modifies the hard seed coat to allow water and gas penetration (Hartman and Kester 1975). Scarification of small lots of seed can be achieved by rubbing the seeds with sandpaper or by cutting the seed coat with a file or razor blade. Seeds can also be soaked in concentrated sulfuric acid for one to two hours, depending on the species, and then rinsed in water for at least ten minutes.

Legume seeds should be inoculated with Rhizobium sp. bacteria just prior to planting. The inoculum may be species specific. Therefore, care must be exercised to obtain the proper inoculum from seed companies.

Forb Introduction

Forbs can be introduced into area by several methods:

1. Direct seeding. Areas must be disturbed to reduce competition from grasses and allow forb seedling establishment. One method utilizes a garden roto-tiller to create 12 inch circular disturbances, about 6 to 8 inches deep, scattered throughout the restoration area. Since a firm seedbed is required for seedling establishment, it is necessary to till the area two to three weeks in advance of seeding.

At the time of seeding, each tilled area should be shallowly hoed, and several seeds of one species planted per tilled area. The number of seeds per area will depend upon the germination percentage. Seed lots with lower germination rates will need to be seeded at heavier rates. Seeds should be covered with about 1/8 to 1/4 inch of soil. The soil should be firmed over the seeds. Disturbed areas that are seeded in the fall should be covered to 1/2 inch with prairie hay, chopped alfalfa, or some other form of mulch to prevent disturbance of the seed. In a dry spring, it would be advisable to irrigate these seeded areas to assure adequate moisture for seedling emergence and establishment.

Just as with germination procedures, appropriate seeding dates vary with forb species. Past research indicates that seeding during the period of October to November or in April usually results in greatest germination. Species showing the best performance from fall seeding included blacksamson echinacea (Echinacea angustifolia), shell-leaf penstemon (Penstemon grandiflorus), and butterfly milkweed (Asclepias tuberosa). Species displaying the best percentages for early spring seeding included Pitchers sage (Salvia pitcherii), purple prairieclover (Petalostemum purpureum), scaly gayfeather (Liatris glabrata), grayhead prairieconeflower (Ratibida pinnata), and small soapweed (Yucca glauca). Species that display equal emergence percentages for both spring and fall seeding include dotted gayfeather (Liatris punctata), thickspike gayfeather (Liatris pycnostachya), and Maximilian sunflower (Helianthus maximiliani) (Salac et al. 1982, Traeger 1982). However, this represents only a small percentage of total forb species found in a native prairie. Therefore, both spring and fall seeding is recommended for species with unestablished seeding dates.

One strategy for a spring seeding is to moist chill and/or scarify a percentage of the seeds before spring planting. This treatment would replace the cold treatment normally given to the seeds through the winter months.

2. Transplanting. Transplanting involves setting out seedlings of various forb species into holes cut in existing sod. The disturbed areas should be large enough to reduce competition from surrounding vegetation until the seedlings become established. Disturbing a 12 inch circular area is also recommended for the transplant method. The transplant should be planted in the center of this disturbed area, mulched, and watered. It is advisable to flag the plant for future reference.

Several methods can be employed to produce forbs to be utilized as transplants:

Method 1. Seeds of the forb species should be started in the greenhouse in flats of vermiculite in July and August. When the first true leaves appear, the seedlings should be transplanted into 4-inch pots or 10-cm super cell tubes. The seedlings; should be grown at 70^{o} greenhouse temperature and fertilized weekly with a general fertilizer such as 20-20-20 at 100 ppm. In October, fertilizing should be discontinued and the temperature of the greenhouse dropped to 45^{o} In November, the plants should be moved outside for overwintering in a coldframe or should be covered with an insulating sheet. The plants should be uncovered in March or early April and transplanted into the field in late April or in early May. This procedure may allow most of the plants to bloom during the first growing season. But, the extra greenhouse time and disturbance of the root system may outweigh the blooming advantage.

Method 2. Seeds of the forbs should be started in the greenhouse in January in flats of vermiculite and grown at a greenhouse temperature of 70^{o} When the first true leaved appear, the seedlings should be transplanted into either 4-inch pots or 10-cm super cell tubed in a commercial potting mixture or a 1:1:1 potting mixture of vermiculite, peat moss, and soil. The seedlings should be fertilized in a weekly basis with an all purpose fertilizer such as 20-20-20 at 100 ppm. Seedlings should be hardened off at the end of April by discontinuing fertilization, reducing greenhouse temperatures to 60 to 65$_{o}$, and reducing watering. The seedlings can then be placed out into the disturbed areas at the begining of May, following danger of frost. By utilizing this method, fall blooming species may bloom the first season, and spring blooming species will bloom the following growing season.

In either case, once the seedlings are placed in the soil there is the chance of considerable mortality from deer, rodents, or insects which are attracted to the disturbed site. Drought conditions caused by moisture competition from surrounding vegetation may also cause losses. For successful establishment, it may be necessary to provide appropriate protection and to supply water to the seedlings for several weeks until establishment is assured.

Method 3. Physically transplanting pieces of native prairie sod for restoration and erosion control was one of the first strategies employed by HNMA. This is still a viable alternative if several conditions are met: 1) locating and securing access to a sod source, 2) quality and composition of the sod source, 3) similar habitat, and 4) sod can be removed with a maximum thickness. Because many prairie plants with a mid- to late summer phenology also have extensively deep root systems, sodding will favor early spring plants with shallower roots. Another sodding strategy would employ the use of a 44 or 66 inch tree spade to transplant large "plugs" of native prairie with less shock to deeply rooted species. The most favorable time would be early spring or late fall.

Method 4. Interseeding can be used to restore areas that may be defficient not only in diversity but also in plant numbers. Interseeding should be performed after burning or mowing and raking eliminate most litter and standing dead plant matter. The soil should be pulverized to form a shallow seedbed between existing plants by harrowing. If the area is small enough, a mixture of forb seeds (or if deficient in plant numbers, forb and grass seeds) can be hand broadcast, incorporated with a rake or harrow, and the seedbed firmed with a large lawn roller. If the area is too large for hand broadcasting, a grass drill can be used. The grass drill may have a standard double-disk opener with depth bands, or it may have openers run by the tractor´s PTO (such as the John Deere Powr-Til Drill). Interseeding results in less control of survival and species composition since it does not generally reduce competition from existing plants. Although the John Deere Powr-Til Drill has attachments for applying strips of herbicides over the seeded row. In cases where the total prairie plant numbers may be low, interseeding may successfully establish competitive plants such as grasses and legumes, but it may have less desirable results for most of the competition sensitive forbs.

Problem Species

Certain forbs can be classified as weedy invaders and should be avoided in restorations. Maximilian sunflower (Helianthus maximiliani) is one such species. A number of the members of the genus Helianthus have been shown to be allelopathic which enables them to reduce competition and spread rapidly by rhizomes. Many of the goldenrods (Solidago spp.) can also become invasive and persist in relatively high densities in restored prairies even when regularly burned.

Grazing

Prairie vegetation evolved under use by grazing animals. Prairies were regularly grazed by large numbers of animals for relatively short periods of time. Many plant adaptations to fire are also adaptations to grazing. Grazing animals were also important as steps in mineral cycling.

Grazing animals are selective for the plant species and plant parts they consume (Stubbendieck and Waller 1983). Therefore, small numbers of animals will consume the most palatable plants first. These are commonly the legumes. Continued grazing will tend to eliminate these plants. Animals will also tend to graze the regrowth of plants previously grazed while ignoring ungrazed plants of the same species. This causes spot grazing, which is a combination of overgrazed and undergrazed areas.

The only way to use grazing in a natural manner is to place extremely large numbers of animals on the area for a period of one to three weeks during a given year. If done correctly, it could be a valuable management tool. But, it would be a difficult system to manage at HNMA.

Mowing and Haying

Without use, standing dead plant material and litter accumulate in a prairie ecosystem. Mowing will eliminate the standing material and the rate of decomposition of litter will increase because particle size will be smaller. However, accelerated decomposition will still be too slow to avoid accumulation. Litter decreases soil temperature and allows undesirable cool season species to increase.

Removal of plant material through haying is one way to prevent the build up of organic matter. Higher spring soil temperatures have been recorded on mowed areas which stimulated early growth of warm season grasses (Rice 1978). Some of the better examples of tallgrass prairie have been preserved in hay meadows that have been mowed for nearly a century. Most prairie species can withstand annual mowing if the mowing date is in mid to late July. This, however, can select against plants which display late summer growth and development.

Mechanical Weed Control

Mowing can also be used as a management tool to decrease undesirable woody species on the prairie, because mowing removes the meristematic tissue located at the tips of the branches. Mowing some weedy herbaceous species during critical periods in their life cycles may be an effective control measure. Mowing may maintain species such as smooth bromegrass at present levels while preventing continued spreading into the prairie.

Handcutting of scattered, nonroot-sprouting plants can be an excellent selective mechanical control measure. Certain trees, thistles, and other broadleaf plants can be controlled in this fashion. Mechanical control of grasses is, however, seldom feasible.

Biological Weed Control

Some species are effectively controlled with biological agents. While grazing can be considered as a biological control method, insects and pathogens have been used as controls. Only limited success has been obtained concerning biological control of any of the weedy species recorded as being present at the Homestead National Monument of America. The most notable example is an insect larvae that feeds on flowers of musk thistle and prevents formation of viable seeds.

Chemical Control of Weeds

Numerous, safe, and effective herbicides are available in today's market. All have been thoroughly tested and pose no problems if the label directions are followed.

The main problem with the use of herbicides on prairies is that the prairie vegetation is composed of a combination of many species of grasses and forbs. Herbicides have generally been developed for use in monocultures. Therefore, certain desirable plants will be controlled along with the target species.

Herbicides could be used to control the woody plant invasion if other methods are not successful. Uses of herbicides for special, localized problem species may be warranted (Appendix III).

Prescribed Burning

Natural fires, caused chiefly by lightning, have always been an important ecological factor of the prairie (Komarek 1966). Expansive prairies were conducive to the free spread of repeated fires, and, therefore, fire was an important selective force in the development of grassland species (Clements 1920, Vogl 1974). With the increasing population and activities of primitive man, the frequency of grassland fires greatly increased (Sauer 1944, Stewart 1951). According to Vallentine (1971), burning is the oldest known practice used by man to manipulate life (both flora and fauna) on prairies.

With these intermittent fires, grasslands evolved which could be readily and repeatedly burned (Mutch 1970). Fire served as a decomposition agent and a key nutrient recycler as it removed dead plant tops that otherwise would accumulate to rather substantial depths (Sauer 1944, Vogl 1974). It also played a major role in maintaining various communities against significant invasion of shrubs and trees (Houston 1957). Considering these factors, grassland ecologists consider fires to be a natural and integral part of most prairie environments (Hanson 1939, Aikman 1955, Costello 1969). Therefore, distribution of most prairie plants has been influenced by fire (Scifres 1980).

Haphazard or accidental fires are often harmful and destructive. Wildfires generally occur when fuel accumulations are dry, relative humidities are low, and wind velocities are high. These fires generally consume nearly all top growth and may damage growing plants

(Launchbaugh 1972). Untimely fires can be destructive and cause undesirable shifts in species composition. Plant succession can be set back (Jackson 1965).

Prescribed burning, which involves controlled fire with consideration of vegetation and weather conditions, maximizes the benefits of a grassland fire. Objectives of present-day prescribed burns on prairie not grazed by domestic livestock may include: control of undesirable plants, removal of litter, improvement of aesthetics, stimulate desirable plants, control insects and diseases, and/or improve wildlife habitat. The degree to which these objectives may be attainable is dependent upon the environmental factors and the influence of burning on these factors and the plant species (Old 1969, Bailey 1978, Launchbaugh and Owensby 1978, Wright 1978).

Burning affects soils in several ways. At the time of the burn, the surface soil temperature will briefly increase but the high temperature of the fire will not directly affect the subsurface soil temperatures (Ahlgren and Ahlgren 1950). However, with the removal of the litter by fire, the ground losses most of its insulating layer. Thus, the soil is not shaded. Hensel (1923) showed that both maximum and minimum soil temperatures averaged 2 C higher for the season on burned areas. Other early research furnished similar results (Steiger 1930, Aldous 1934). This temperature increase is generally proposed to be the major cause for the appearance of grass shoots on fresh burn from one to three weeks earlier in the growing season.

Aldous (1934) pointed out that the upper meter of soil of burned bluestem prairie was drier than that of adjacent unburned prairie. Most research has clearly shown that soil moisture at all depths is appreciably reduced (Anderson 1965). Removal of litter on burned areas caused a decreased infiltration rate and increased runoff and evaporation rates. These phenomena are least important with late-spring (May 1) fires, especially when followed by rainfall and rapid growth of prairie plants. Early-spring (March 20) fires left the soil surface unprotected from loss by runoff, evaporation, and surface erosion for a substantial period before new growth began (Anderson 1965, Anderson et al. 1970).

Sharrow and Wright (1977) determined that the increase in soil temperature in burned prairie increased nitrate production by soil microbes. At optimum soil temperatures, nitrate ions were rapidly produced by bacteria and rapidly used by vigorously growing prairie plants.

Soil organic matter was not altered by annual prescribed burning (Launchbaugh and Owensby 1978). The main source of soil organic matter was roots. Mulch contributed little to soil organic matter. Therefore, removal of much of the mulch layer by fire had little effect on soil organic matter levels. In addition, burning caused some minor fluctuations in soil pH and the availability of phosphorus, calcium, and magnesium.

The effects of burning prairie varies according to species, location, condition of the vegetation, season of burning, stage of growth, and many other characteristics of the prairie as well as the character of the burn. Botanical composition serves as an indicator concerning long-term effects of management systems on vegetation. The date of burning in relation to growth cycle of a given species largely determines the extent the species increases or decreases under burning treatment. Those species actively growing when the prairie is burned are much more susceptible to injury and death than are dormant species or those just starting to grow (Anderson et al. 1970).

Two of the main reasons for using fire as a management tool on prairies are to reduce competition from cool season plants and to suppress encroachment of trees and shrubs. Kentucky bluegrass decreased 80% or more following a spring burn (Hensel 1923, Ehrenreich 1959, Old 1969, Launchbaugh and Owensby 1978). Similarly, Japanese brome and smooth brome-grass were damaged by properly timed burns (McMurphy and Anderson 1965, Old 1969). Late spring burning reduced most forbs, although the composition of grasses changed relatively little (McMurphy and Anderson 1965, Launchbaugh and Owensby 1978). Woody plants may invade a protected prairie, but late-spring burning can effectively control most small woody plants (Penfound 1964, Vogl 1967).

GENERAL RECOMMENDATIONS

Based on a thorough review of objectives and goals for HNMA, the existing site, past practices, and specific management techniques; it is recommended that:

1. All future management activities be documented. It is suggested that a form (Appendix IV), or some variation of it, be filed with this document (Vegetation Survey and Management Recommendations for HNMA) as an ongoing record of management activities and natural events. This information must be routinely documented in space (on maps) and in time (date, year).

2. The National Park Service solicit management proposals for the restoration and management of the woodland areas within HNMA.

3. The National Park Service prepare a masterplan or solicit proposals for a masterplan to address design issues such as: A) all manmade and natural features be identified, B) priorities be assigned to them on their interpretive value, C) conflicts among outside features and between off-site features be analyzed and assigned priorities based on their interpretive value, D) identify new interpretive displays (e.g. hedgerow), E) a landscape plan be produced and integrated with the long-term management goals of adjacent and visually important property, F) the landscape plan is integrated with the vegetation management plan, G) future scenic easements or acquisitions are identified, H) National Park Service personnel meet with and exchange concerns with the Gage County Commissioners and county planners regarding detrimental changes in surrounding land use. These issues are beyond the scope of a

vegetation analysis and management plan.

4. All botanical and common names conform to those in the publication Common and Scientific Names of Nebraska, Native and Introduced, Publication Number 101 of the Nebraska Statewide Arboretum (Appendix V).

5. HNMA actively participate in the soil and water conservation efforts of the Lower Big Blue Natural Resources District, specifically taking interest in flood control measures upstream on Cub Creek and its tributaries.

6. HNMA serve as a clearing house and possible repository for the threatened local gene pool represented in a few remnants of local prairie flora. The work by Kathy Patrick could be considered to be the start of this activity. HNMA has the opportunity to preserve not only the cultural but also the threatened natural heritage present in the local prairie plant gene pool.

7. HNMA develop close ties with scientists involved in prairie management and restoration by promoting the HNMA prairie as a site for study and research on prairie restoration.

8. The management plan should be updated at the minimum of every ten years by closely reviewing the following points: A) review and revision of the goals and objectives statement, B) analysis of trends in vegetative composition in the two to three year cycle of sampling, C) review of herbicide use, D) review of other management techniques and their effectiveness, E) review of natural events such as floods and wildfires, F) produce a 5-year work plan with labor and materials budget, G) analyze outside advice and opinions regarding management and restoration in the context of the management goals and objectives, and

H) train a HNMA technician in the use of specific sampling technique (e.g. modified step-point method) for species composition and identification of prairie plants.

9. Develop and interpretative display focusing on the early restoration efforts in the establishment of HNMA. The nearly 50 years that have passed since the beginning of restoration provides an interesting story of the relationships of man and land.

AREAS OF CRITICAL CONCERN

Critical areas of concern (locations are given in Figure 9, page 17) are simply special problem areas identified by either HNMA personnel in their goals and objectives or through site investigations by the researchers.

1. Disturbed Lowland Prairie. Generally, the low-lying areas below contour 1270 are the most disturbed portions of the HNMA site. Original seeding mixtures were primarily of upland species. In addition, continual disturbance by flooding has promoted an unstable, undesirable, and visually displeasing area. However, some portions of the lowlands are more disturbed than are others. The southwest one-half of Quadrat 1, the northwest one-half of Quadrat 4, and the northeast one-quarter of Quadrat 3 are the most visible and most disturbed.

2. State Highway 4 Right-of-way. The State Highway 4 right-of-way creates several problems for HNMA. Because of the current Nebraska Department of Roads policies, the area is not mowed, and eastern redcedars over 6 inches in diameter are not removed. It, thus, serves

as a seed source for undesirable species, such as smooth bromegrass and eastern redcedar. While the triangular area is not a legal part of HNMA, the perceived visual boundary actually occurs at the edge of the road. This triangular area also has the potential of serving as a screen or buffer from the intrusive residential development located north of State Highway 4. Congress should authorize purchase of the triangle, or a joint management plan should be worked out between HNMA and the State Department of Roads.

3. Old State Highway 4 Right-of-way. The old right-of-way follows the alignment of the historical St. Joseph to Fort Kearny Stage Road. However, in building the road to automobile requirements, the contour was changed. Trees and shrubs invaded the right-of-way. The old road is now part of the HNMA trail system. Because of the affinity of woody species for the fill next to the old road, a strongly linear, unnatural form is evident in the midst of the restored prairie. Because of the view of visitors arriving from the east on Highway 4, this linear form unfortunately becomes a focal point for the traveling public (see Figure 3). Selective thinning and management of the shrubs should be initiated to naturalize this feature.

4. Osage-orange Hedgerow. In the interest of interpreting the cultural and ecological importance of the osage-orange hedgerow at HNMA, it is suggested that one section of at least 100 yards in length be maintained with the traditional plashing, pruning, and braiding as done by the homesteaders. All other woody species should be removed from this maintained section. References for the upkeep and interpretation of the hedgerow are listed in the bibliography (Overman 1858, Warden 1865, Powell 1900, Winberry 1979, and Smith and Perino

1981). A large portion of the hedgerow should receive little or no management attention to allow it to approximate the majority of old hedgerows as they are seen today.

An additional loop trail heading from the Freeman graves to near the intersection of Quadrats 15 and 16 at the south property line would allow visitors a better view of the upland prairie flora and the proposed interpretative feature at the osage-orange hedge. The trail could then loop northwest to the Agnes Suiter Freeman cabin site, passing the stabilized gullies, and move through one or more woody thickets.

5. Offsite Erosion. Conservation structures and erosion control practices should be reviewed with the local Natural Resources District personnel and the property owner to the south. The owner should be strongly encouraged to keep erosion from damaging the resources at HNMA.

6. Upland Gully Erosion. The cutting process in the formerly active, eroding gullies in Quadrats 14 and 15 (see Figures 4 and 5) has been slowed. However, they are sensitive to runoff because of the coarse texture of the soil. Baled prairie hay dams, as currently employed, can slow the water and impound silt. These should be checked each spring and fall and replaced as needed. As time and budget allow, these areas should be sodded with upland prairie sod. Sodding should begin at the highest elevation and be thoroughly established before additional sod is added down the slope. Before sodding, it may be a useful alternative to incorporate a flexible plastic pipe drain in the bottom of the gully and a check dam and inlet at the south property line. Size of the pipe would depend on the greatest projected volume

of runoff. This proceaure would eliminate the surface cutting action of runoff, but it would be expensive.

7. Tree Intrusion. Trees were not naturally found in prairies in this area, except in association with streams. Those trees that were planted by Freeman and his descendents, however, are in direct conflict with the objective of prairie restoration. While trees provide shade to the visitor and the largest one in the area of the Agnes Suiter Freeman cabin site may have historical significance (see Figures 1, 6, and 11), they are detrimental to the growth of prairie plants and to the visual concept of prairie space. All trees except, perhaps, the largest one-half dozen should be removed. Upon the natural death of the large trees, they should not be replaced. It will also be necessary to monitor the area around the trees to locate all seedlings for removal.

8. Weeds in the Lowland Prairie. While area 8 (Figure 9) contains the largest population of perennial natives which display a weedy nature, the weedy problem can be found throughout the lowland. Also included as problem species are exotic species such as musk thistle, common mullein, and smooth bromegrass. Until the lowland prairie and other areas of disturbance, such as the pioneer crops area, are restored and stabilized, weeds will be a reoccurring problem. Native species with weedy characteristics are less of a problem than are the exotic species. Patrol and monitoring of the weed situation should continue as a routine management activity. Manual mechanical methods or spot use of herbicides should be employed. Generally, extensive use of herbicides is not recommended.

9. Pioneer Crops Area. As an interpretative feature, the pioneer crops area serves a useful purpose. Its location and configuration, however, do not reenforce its mission. It now serves as a weed source and a visual intrusion in the prairie. It is recommended that it be relocated west of Cub Creek in conjunction with the other interpretative displays. As an alternative, it could be located in the general area of the existing native plant garden. Like the native plant garden, the crops area must be carefully integrated into the landscape so as to not dominate the visitors' first view of the restored prairie. It must be managed carefully so that it does not become a weed source.

10. Woodland. Critical area 10 is located south of State Highway 4 and adjacent to Cub Creek. The woodland was very nearly completely degraded when the area was obtained by the NPS. Only a few large trees remained. It had been heavily overgrazed for about 60 years. An accurate record of the locations of the original margins between the woodland and the shrubland and between the shrubland and the prairie does not exist.

While it is beyond the purview of this management plan to address the woodlands at HNMA, it is recommended that a contract be let for woodland studies. It should be surveyed and evaluated much in the same manner as were the prairies. It may even be desirable to convert most of Quadrat 1 to a combination of woodland and shrubland. With only a cursory investigation, it appears that the species diversity in the woodland is very poor. However, since the canopy is now closed, the introduction of many woodland forbs and understory plants is possible.

11. Woodland North of State Highway 4. This area is similar to Critical Area 10. Because of its relative distance from other portions of HNMA and its small size, it could serve as the initial woodland restoration area.

12. Freeman School Prairie Remnant. The Freeman School upland prairie is significant because it represents the only unplowed, non-restored prairie on the HNMA site. It is highly visible to passing travelers. It has severe management problems because of its small size and encroachment of smooth bromegrass into its edges. Areas of recent excavation around the school building will require revegetation. Specific restoration strategies are noted under the section entitled "Intensive Prairie Restoration."

13. Shrub Edge. The prairie/shrub and shrub/woodland edge represents one of the most diverse and visually interesting portions of HNMA. Appropriate sites should be selected and managed for the interpretation of this important ecological zone. These edges or ecotones are dynamic and can be a difficult feature to manage (see Figure 14). The edges could be maintained by prescribed burning. Selection of the location of the edge is problematical because there is no accurate record of the original edge. Shrubs to include in such an ecotone are:

Rough dogwood (Cornus drumondii)

American hazelnut (Corylus americana)

Common pricklyash (Zanthoxylum americanum)

Thicket serviceberry (Amelanchier canadensis)

American elderberry (Sambucus canadensis)

American plum (Prunus americana)

Common chokecherry (Prunus virginiana)

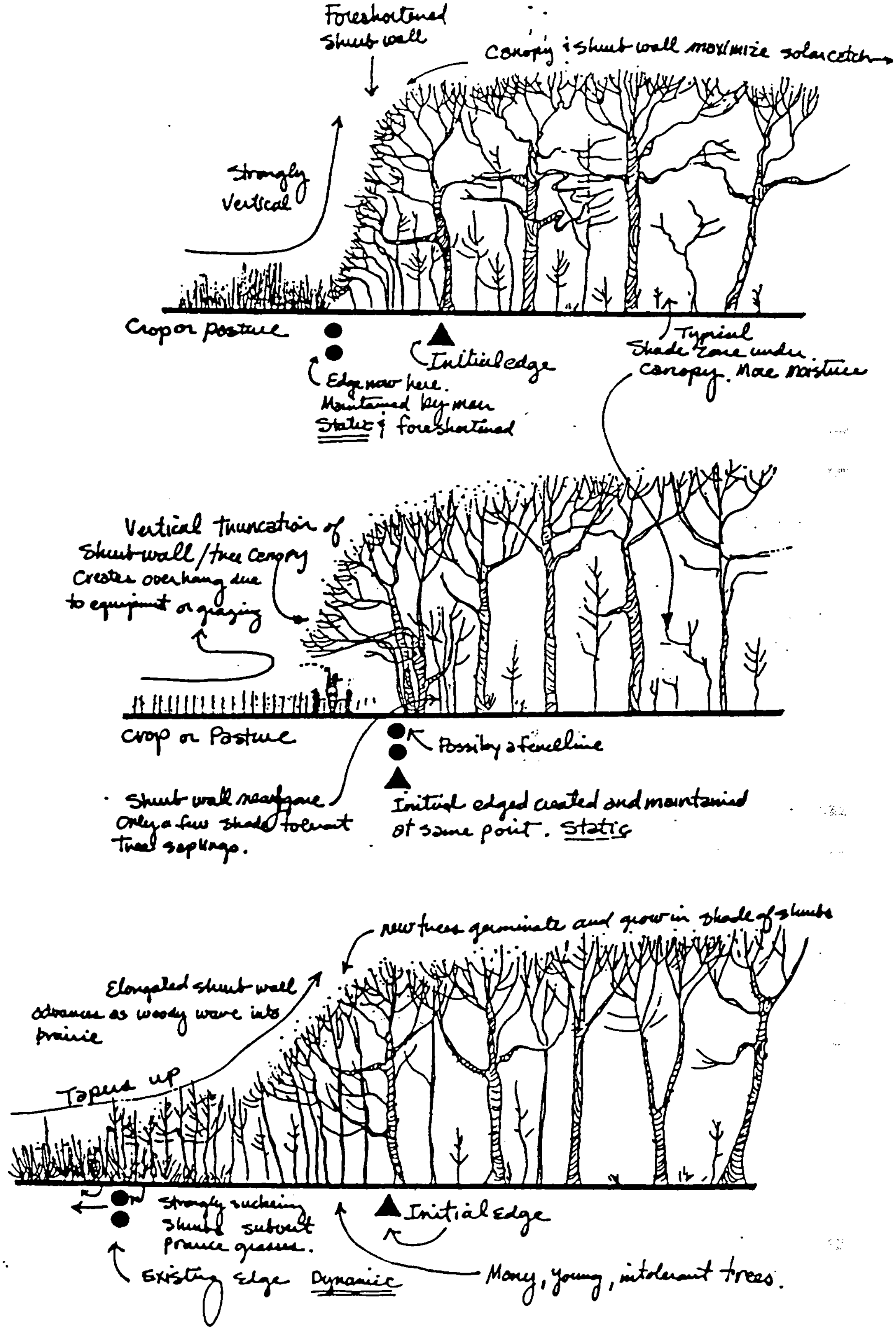

Figure 14. Shrub Edge Dynamics

DIAGRAMS ADAPTED FROM: RANEY, BRUNER & LEVENSON 1981 "THE IMPORTANCE OF EDGE IN THE STRUCTURE AND DYNAMICS OF FOREST ISLANDS" IN BURGESS & SHARPE.

If a woodland and shrub screen is deemed necessary along the State Highway 4 right-of-way, the above woody species should be used.

14. Shrub Intrusion into the Prairie. Thickets of American plum, smooth sumac, and gray dogwood can be found throughout the prairie (see Figures 11 and 12). Recent prescribed burns have reduced some of the thickets. As well, mechanical shredding also helps limit their spread. Many species of shrubs spread by underground suckers, and burning will probably control the top growth. It may be impossible to get complete top control by burning because dense thickets do not allow accumulation of fine fuel. Therefore, removal of these thickets or even control of their size may require the use of shredding or herbicides to reduce the top growth for one year. Prescribed burning should then control the new shoots.

Shrubs are a small, but integral, part of prairie vegetation. A few selected thickets should be allowed to remain to provide shade, wildlife habitat, botanical diversity, and visual diversity. It will be important to keep the thickets small and manageable. The number and configuration of thickets should be carefully determined.

These critical areas can be further understood from the following priorities generated by applying the following criteria: 1) rating the speed or severity of resource degradation, 2) feasibility of restoration in time and money, and 3) impact of the critical area on the aesthetic quality of the visitors' experiences. For each of the identified critical areas of concern, a rating total was tabulated and a priority proposed (Table 12).

Table 12. Priority rating matrix for the critical areas of concern (see page 86 for an explanation of the column ratings).

criteria / area	speed or severity of resource degradation	feasibility of restoration	existing aesthetic impact	Total	Priority
1. Lowland Prairie	3	1	3	7	3
2. Highway 4 R-O-W	2	2	3	7	2
3. Old Highway 4 R-O-W	1	2	2	5	9
4. Osage-orange Hedgerow	1	2	2	5	10
5. Offsite Erosion	2	2	1	5	11
6. Upland Gully Erosion	1	3	1	5	12
7. Tree Intrusion	1	3	2	6	5
8. Weeds in Lowland Prairie	2	1	2	5	8
9. Pioneer Crops Area	2	1	2	5	7
10. Woodland Area	2	1	1	4	14
11. Woodland North of Highway	2	1	2	5	13
12. Freeman School Prairie Remnant	3	2	3	8	1
13. Shrub Edge	2	2	2	6	6
14. Shrub Intrusion into Prairie	3	2	2	7	4

Explanation of column headings in Table 12 on page 85:

Speed or severity of resource degradation:

1 = slow or stable
2 = moderate
3 = severe

Feasibility of restoration:

1 = expensive and time consuming
2 = moderate
3 = relatively inexpensive and rapid

Existing aesthetic impact:

1 = unseen or not visually intrusive
2 = apparent
3 = highly intrusive

INTENSIVE PRAIRIE RESTORATION

Lowland Prairie

Subsections of the lowland can be delineated by the contour intervals: 1) below 1260 (wet lowland), 2) between 1260 and 1265 (mesic lowland), and 3) between 1265 and 1270 (dry lowland). These areas and their configurations should be obtained by a topographic survey to the 0.5 foot contour interval for quadrat 4, quadrat 1 (south of Highway 4), and quadrat 3 (east of the woodland). These areas can then be phased for long-term restoration. Targeted species composition for each of the three areas should be as follows in Tables 13, 14, and 15.

Table 13 . Target species composition (%) for restoration of the wet lowland prairie, below contour 1260. Seeds from species marked with * were collected in 1984 by Kathy Patrick.

Species	Target Species Composition
	------%-----
Major grasses and sedges:	
Prairie cordgrass* <u>Spartina pectinata</u>	76
Canada wildrye* <u>Elymus canadensis</u>	2
Switchgrass* <u>Panicum virgatum</u>	5
Sedges* <u>Carex spp.</u>	4
Reed canarygrass <u>Phalaris arundinacea</u>	8

American sloughgrass Beckmannia syzigachne	1

Forbs, reeds, and minor grasses (total to 4%):

Catchweed bedstraw (Galium apartine)
Sawtooth sunflower (Helianthus grosseserratus)
Wild strawberry (Fragaria virginiana)
Canada goldenrod (Solidago canadensis)
Canada anemone (Anemone canadensis)
Field horsetail (Equisetum laevigatum)
Fringed loosestrife (Lysimachia ciliata)
Swamp milkweed (Asclepias incarnata)
Swamp smartweed (Polygonum coccineum)
Canada onion (Allium canadense)*
Palespiked lobelia (Lobelia spicata)*
Indiangrass (Sorghastrum nutans)*
Big bluestem (Andropogon gerardii)*
Purple meadowrue (Thalictrum dasycarpum)
Marsh vetch (Lathyrus palustris)
Virginia wildrye (Elymus virginicus)

Table 14. Target species composition (%) for restoration of the mesic lowland prairie, between contours 1260 and 1265. Seeds from species marked with * were collected in 1984 by Kathy Patrick.

Species	Target Species Composition
	------%------
Major grasses and sedges:	
Prairie cordgrass* Spartina pectinata	36
Switchgrass* Panicum virgatum	42
Canada wildrye* Elymus canadensis	1
Reed canarygrass Phalaris arundinacea	1
Big bluestem* Andropogon gerardii	13

Indiangrass* *Sorghastrum nutans*	1
Sedges* *Carex spp.*	2

Forbs and minor grasses (total to 4%):

Catchweed bedstraw (*Galium apartine*)
Compassplant (*Silphium lactiniatum*)*
Wild strawberry (*Fragaria virginiana*)
Canada goldenrod (*Solidago canadensis*)
Prairie phlox (*Phlox pilosa*)
Prairie dogbane (*Apocynum sibiricum*)
Mountain-mints (*Pycnanthemum spp.*)
Black-eyedsusan (*Rudbeckia hirta*)*
Sneezeweed (*Helenium autumnale*)
Violet woodsorrel (*Oxalis violaceae*)
Illinois tickclover (*Desmodium illinoense*)*
Willow aster (*Aster praealtus*)
American germander (*Teucrium canadense*)*
Hypoxis (*Hypoxis hirsuta*)
Cup rosinweed (*Silphium perfoliatum*)*
Virginia wildrye (*Elymus virginicus*)*
Eastern gamagrass (*Tripsacum dactyloides*)*

Table 15. Target species composition (%) for restoration of the dry lowland prairie, between contours 1265 and 1270. Seeds form species marked with * were collected in 1984 by Kathy Patrick.

Species	Target Species Composition
	------%------
Major grasses:	
Big bluestem* *Andropogon gerardii*	76.0
Indiangrass* *Sorghastrum nutans*	8.5
Switchgrass *Panicum virgatum*	8.0

Canada wildrye* Elymus canadensis	0.5
Prairie cordgrass* Spartina pectinata	3.0

Forbs and minor grasses (total to 4%):

Catchweed bedstraw (Galium apartine)
Wild strawberry (Fragaria virginiana)
Canada goldenrod (Solidago canadensis)
Compassplant (Silphium laciniatum)*
Wholeleaf rosinweed (silphium integrifolium)
Golden alexanders (Zizia aurea)
Prairie dogbane (Apocynum sibiricum)
Meadow violet (Viola pratincola)
American licorice (Glycyrrhiza lepidota)*
Smooth milkweed (Asclepias sullivantii)
Purple loosestrife (Lythrum salicaria)
Fleabane (Erigeron philadelphicus)
Grayhead prairieconeflower (Ratibida pinnata)*
Cup rosinweed (Silphium perfoliatum)*
Illinois tickclover (Desmodium illinoense)*
Cudweed sagewort (Artemisia ludoviciana)
Violet woodsorrel (Oxalis violaceae)
Little bluestem (Schizachyrium scoparium)*
Panic grasses (Dichanthelium spp.)
Prairie dropseed (Sporobolus heterolepis)*

These represent a gradation from moisture-loving plants to those requiring less moisture with percentage compositions changing in response. The 96% grass cover and 4% forb and minor grass cover approximates the cover pattern determined by Weaver (1954) (Table 1). However to increase visual continuity, catchweed bedstraw, wild strawberry, and Canada goldenrod are found in each of the three subsections. With grass composition, prairie cordgrass gives way to big bluestem as one moves from wetter to drier habitats. Switchgrass should not be sown at the rates indicated by the target percentage, because it will produce seed and rapidly increase. It is recommended that the seeding rate be only 1 or 2% of the total. By selecting roughly 0.5 to 1.0 acre restoration sites within one of the three subsections, a mosaic of plants can result.

Transplants should be grown from the forb and minor grass list the January prior to their planting. It should be noted that Kathy Patrick has collected seeds from species marked in the tables with "*". The area selected for planting should be outlined to keep away from rectilinear forms. It could be sterilized with methyl bromide or clean cultivated for one year prior to planting the mixture of grass seeds. Note: If the area floods, it must be clean cultivated for an additional year. The grass seeding should be sown in late spring (May), mulched, irrigated, and weeded for one year. Transplants can be placed into the grass matrix, one year following grass seeding, at random to account for approximately 5 to 8% of the initial cover.

An alternative to the transplant method would be to use lowland sod strips. It may be difficult, however, to locate strips that would contain a species composition similar to the target composition.

The area should be burned in March three years following transplanting. If the area floods one to three years after planting, the stand must be sampled and evaluated to determine if it should be abandoned and replanted because of a weed influx.

A completely different approach for the lowland in Quadrant 1 would be to convert it to a flood plain forest type of woodland. The biggest disadvantage would be to increase the distance a visitor must walk to reach the prairie area.

Seeded/Sodded &
~~B~~ transplanted
in 86
Burn 89?

Upland Prairie

Generally, the upland prairie above contour 1270 is sound. Restoration of the upland prairie remnant at the Freeman School, however, is discussed below. Upland species collected by Kathy Patrick can be grown and simply transplanted into the upland to increase species diversity.

The technique to use here is the same as for transplanting of lowland forbs. It is covered under the section on forb introduction. Quadrats 14, 15, and 16 above contour 1280 are reasonably diverse. Therefore, forb enrichment should be concentrated in Quadrats 12, 13, and 5 and in the lower portions of 14, 15, and 16. The areas are large, and the needs are not critical. So, a long-term transplanting program which concentrates on one or two species at a time would be most successful. It should also be understood that greater survival of transplants may require irrigation, weeding, and mulching. As well, the germination and transplant growth requirements are unknown for many of the forbs.

Restoration of the prairie remnant at the Freeman School is critical because it is being threatened by the invasion of the pernicious, exotic smooth bromegrass. The smooth bromegrass threat must be eliminated and the matrix of warm season grasses increased in density, diversity, and vigor before forb enrichment is initiated. Smooth bromegrass may be reduced in several ways. 1. Repeated early spring burning will weaken the cool season grass before the warm season grasses break dormancy. 2. Certain herbicides can also be effective if applied at the proper rate and time. Atrazine can be applied in late fall or in early spring. It effects cool season grasses, like smooth bromegrass, and has little effect on most warm season prairie grasses. It may reduce forb populations, but few forbs are growing the the areas of high densities of smooth bromegrass. Glyphosate is an alternative herbicide. It is a systemic herbicide that must be absorbed by green tissue. Therefore, it could be applied early in the spring immediately after smooth bromegrass starts growth and before the prairie species initiate growth. A period of at least two weeks and possibly as long as four weeks each spring would be proper for this herbicide application. All regulations and instructions on the herbicide label should be followed. Herbicide applications may need to be repeated in subsequent years. Restoration should not proceed until the smooth bromegrass is controlled. The native warm season grasses should naturally increase in the treated areas. Forbs will need to be transplanted into the area.

The disturbed areas surrounding the Freeman School will need more intensive restoration. A cover crop of annual ryegrass or sorghum could be used to prevent erosion. Techniques similar to those recommended for the lowland prairie can be used. A potential list of species may be found in Table 1.

PLANT COLLECTION

An herbarium collection consisting of two sets of plants was assembled for HNMA during 1983 and 1984. The collections were deposited in the herbarium cabinets at HNMA. List of species collected is presented in Table 16.

Plant Collection

Representatives of each species found at HNMA were collected, pressed, and dried using standard procedures. Collector, collection number, Quadrat, date of collection, and any additional information were recorded in a field notebook at the time of collection.

Identification

Each specimen was identified through the use of one or more dichotomous keys. Sources used for identification purposes are listed in the Bibliography.

Mounting

The specimens were mounted with a plastic medium on the highest quality, standard size (11.5 by 16.5 inches), pH neutral, 100% rag herbarium paper. Narrow strips of gummed white cloth tape were used to secure large specimens.

Labeling

Special herbarium labels were printed on 100% rag paper for this collection. Herbarium labels were attached with plastic medium to the lower right corner of the herbarium paper. The following information is found on each label: family, tribe, genus, specific epithet, authority, Quadrat in which the specimen was collected, date of collection, name of the collector, and the collector's specimen identification number.

Herbarium Inventory Number

An inventory number (starting with 001) was stamped near the upper right corner of each herbarium sheet. A book with all of these entries accompanies the collection and should be stored with the collection so that future additions may be entered into the book.

Herbarium Arrangement

Individual genus covers are labeled in the lower right with the genus name. These covers should be arranged and filed in the herbarium alphabetically by genus.

Laminated Specimens

A second set of specimens was heat laminated in plastic film after being mounted and labeled. These specimens will withstand much heavier use than will the standard specimens, although the plastic film will limit their use for future taxonomic work. It is envisioned that these mounts could be taken to the field for identification comparisons.

Care and Handling of Specimens

A properly cared for specimen should last indefinitely, but carelessness or abuse can quickly ruin a collection. Plants filed in a cabinet with a tight fitting door are protected from moisture, dirt, and insects. Insects are a common cause of damage, and moth balls (paradichlorobenzene) placed in the herbarium cabinet with the collection should prevent damage. The cabinet door should be kept tightly closed when specimens are not in use.

Care and judgement should be exercised in the examination and handling of specimens. They should not be bent, turned over like pages in a book, or subjected to abrasion or pressure. Leaves and other plant parts are easily broken when specimens are slid across each other. When examining specimens, they should be picked up individually and stacked carefully.

Table 16. Species collected at Homestead National Monument of America. The symbol * indicates an introduced or exotic species.

Scientific Name	Common Name
Grasses:	
Agrostis hyemalis (Walt.) BSP	winter bentgrass
Andropogon gerardii Vitman	big bluestem
Bouteloua curtipendula (Michx.) Torr.	sideoats grama
Bromus commutatus Schrad.	hairy chess *
Bromus inermis Leyss.	smooth bromegrass *
Bromus japonicus Thunb.	Japanese brome *
Buchloe dactyloides (Nutt.) Engelm.	buffalograss
Cenchrus longispinus (Hack.) Fern.	field sandbur
Dichanthelium oligosanthes var. scribnerianum (Nash) Gould	Scribner dichanthelium
Dichanthelium oligosanthes var. wilcoxianum (Vasey) Gould & Clark	Wilcox dichanthelium
Digitaria sanguinalis (L.) Scop.	hairy crabgrass *
Echinochloa crusgali (L.) Beauv.	common barnyardgrass
Elymus canadensis L.	Canada wildrye
Elymus virginicus L.	Virginia wildrye
Eragrostis cilianensis (All.) E. Mosher	stinkgrass *
Eragrostis pilosa (L.) Beauv.	India lovegrass *
Eragrostis spectabilis (Pursh) Steud.	sand lovegrass
Festuca obtusa Biehler	nodding fescue
Hordeum pusillum Nutt.	little barley
Koeleria pyramidata (Lam.) Beauv.	prairie junegrass
Muhlenbergia frondosa (Poir.) Fern.	wirestem muhly
Panicum capillare L.	common witchgrass
Panicum dichotomiflorum Michx.	fall panicum
Panicum virgatum L.	switchgrass
Phalaris arundinacea L.	reed canarygrass
Poa pratensis L.	Kentucky bluegrass *
Schizachyrium scoparium (Michx.) Nash	little bluestem
Setaria glauca (L.) Beauv.	yellow bristlegrass *
Sorghastrum nutans (L.) Nash	indiangrass
Spartina pectinata Link	prairie cordgrass
Sporobolus heterolepis (Gray) Gray	prairie dropseed
Stipa spartea Trin.	porcupinegrass

Tridens flavus (L.) Hitchc.	purpletop
Tripsacum dactyloides L.	eastern gamagrass

Other Monocots:

Carex spp. L.	sedges
Sisyrinchium angustifolium Miller	common blue-eyedgrass
Tradescantia bracheata Small	bracted spiderwort

Legumes (including woody species):

Amorpha canescens Pursh	leadplant
Astragalus canadensis L.	Canada milkvetch
Baptisia leucophaea Nutt.	plains wildindigo
Cassia fasciculata Michx.	showy partridgepea
Desmodium illinoense Gray	Illinois tickclover
Glycyrrhiza lepidota Pursh	American licorice
Lespedeza capitata Michx.	roundhead lespedeza
Melilotus albus Desr.	white sweetclover
Melilotus officinalis (L.) Lam.	yellow sweetclover
Petalostemon candidum (Willd.) Michx.	white prairieclover
Petalostemon purpureum (Vent.) Rydb.	purple prairieclover
Psoralea tenuiflora Pursh	slimflower scurfpea
Trifolium repens L.	white clover
Vicia americana Muhl.	American vetch

Composites (including woody species):

Achillea millefolium L.	western yarrow
Ambrosia artemisiifolia L.	common ragweed
Ambrosia psilostachya DC.	western ragweed
Ambrosia trifida L.	giant ragweed
Antennaria neglecta Greene	field pussytoes
Artemisia ludoviciana Nutt.	cudweed sagewort
Aster ericoides L.	heath aster
Aster simplex Willd.	panicle aster
Carduus nutans L.	musk thistle *
Cirsium altissimum (L.) Spreng.	tall thistle
Cirsium undulatum (Nutt.) Spreng.	wavyleaf thistle
Conyza canadensis (L.) Cronq.	horseweed
Echinacea angustifolia DC.	blacksamson echinacea
Erigeron strigosus Muhl.	daisy fleabane
Eupatorium rugosum Houtt.	white snakeroot
Grindelia squarrosa (Pursh) Dunal	curlycup gumweed

Helianthus annuus L.	common sunflower
Helianthus rigidus (Cass.) Desf.	stiff sunflower
Hieracium longipilum Torr.	longbeard hawkweed
Kuhnia eupatoriodes L.	false boneset
Latuca oblongifolia Nutt.	blue lettuce
Latuca serriola L.	prickly lettuce *
Liatris punctata Hook.	dotted gayfeather
Ratibida pinnata (Vent.) Barnh.	grayhead prairie-coneflower
Rudbeckia hirta L.	black-eyedsusan
Senecio plattensis Nutt.	prairie groundsel
Silphium integrifolium Michx.	wholeleaf rosinweed
Solidago gigantea Ait.	giant goldenrod
Solidago missouriensis Nutt.	Missouri goldenrod
Solidago rigida L.	stiff goldenrod
Taraxacum officinale Weber	common dandelion *
Tragopogon dubius Scop.	western salsifly *
Verbesina alternifolia (L.) Britt.	wingstem
Vernonia fasciculata Michx.	western ironweed

Other Dicot Forbs (except legumes and composites):

Agalinis tenuifolia (Vahl.) Raf.	slender agalinis
Amaranthus hybridus L.	slender pigweed *
Amaranthus retroflexus L.	rough pigweed *
Androsace occidentalis Pursh	western rockjasmine
Apocynum cannabinum L.	hemp dogbane
Asclepias syriaca L.	common milkweed
Asclepias tuberosa L.	butterfly milkweed
Asclepias verticillata L.	whorled milkweed
Callirhoe alcaeoides (Michx.) Gray	pink poppymallow
Campanula americana L.	tall bellflower
Capsella bursa-pastoris (L.) Medic.	shepherdspurse
Chenopodium album L.	lambsquarters *
Convolvulus arvensis L.	field bindweed *
Corydalis crystallina Engelm.	mealy corydalis
Draba reptans (Lam.) Fern.	white whitlow-wort
Ellisia nyctelea L.	waterpod
Euphorbia dentata Michx.	toothed spurge
Euphorbia marginata Pursh	snow-on-the-mountain
Euphorbia nutans Lag.	nodding spurge
Fagopyrium esculentum Moench	buckwheat
Fragaria virginiana Duchn.	wild strawberry
Galium aparine L.	catchweed bedstraw

Gentiana pubrelenta Pringle	downy gentian
Geum canadense Jacq.	white avens
Hibiscus trionum L.	flower-of-an-hour *
Lamium amplexicaule L.	henbit *
Lepidium densiflorum Schrader	densely-flowered pepperweed
Lithospermum incisum Lehm.	cleft gromwell
Lomatium foeniculaceum Nutt. Coult. & Rose	carrotleaf lomatium
Mirabilis nyctaginea (Michx.) MacM.	prairie four-o'clock
Monarda fistulosa L.	wild bergamont
Orobanche fasciculata Nutt.	bunched broomrape
Oxalis stricta L.	common yellow woodsorrel
Oxalis violacea L.	violet woodsorrel
Physalis virginiana Mill.	lanceleaf groundcherry
Phytolacca americana L.	pokeberry
Plantago rhodosperma Dcne	redseed plantain
Plantago rugelii Decne.	blackseed plantain
Polygonum arenastrum Jord. ex Bor.	common knotweed *
Polygonum pensylvanicum L.	Pennsylvania smartweed
Potentilla arguta Pursh	tall cinquefoil
Ranunculus abortivus L.	early wood buttercup
Rumex altissimus Wood	pale dock
Salvia pitcheri Torr.	Pitchers sage
Saponaria officinalis L.	bouncingbet *
Sicyos angulatus L.	burcucumber
Teucrium canadense L.	hairy germander
Thlaspi arvense L.	field pennycress *
Triodanis leptocarpa (Nutt.) Nieuw.	slenderfruit Venus-lookingglass
Triodanis perfoliata (L.) Nieuw.	clasping Venus-lookingglass
Urtica dioica L.	stinging-nettle
Verbascum thapsus L.	common mullein *
Verbena bracteata Lag. & Rodr.	bracted verbena
Verbena hastata L.	blue verbena
Verbena stricta Vent.	woolly verbena
Veronica arvensis L.	corn speedwell *
Viola missouriensis Greene	Missouri violet
Viola pedatifida G. Don	prairie violet
Viola rafinesquii Greene	johnny-jump-up

Woody Plants:

Acer negundo L.	boxelder
Acer saccharinum L.	silver maple
Celtis occidentalis L.	hackberry
Cornus racemosa Lam.	gray dogwood
Fraxinus pennsylvanica Marsh	green ash
Gleditsia triacanthos L.	honeylocust
Juglans nigra L.	black walnut
Juniperus virginiana L.	eastern redcedar
Maclura pomifera Schneid.	osage-orange
Morus alba L.	white mulberry *
Parthenocissus quinquefolia L.	Virginia creeper
Parthenocissus tricuspidata Planch.	Boston ivy *
Populus deltoides Bartr.	eastern cottonwood
Prunus americana Marsh.	American plum
Prunus virginiana L.	common chokecherry
Quercus macrocarpa Michx.	bur oak
Rhus glabra L.	smooth sumac
Rhus trilobata Nutt.	skunkbush
Ribes missouriense Nutt.	Missouri gooseberry
Rosa arkansana Porter	Arkansas rose
Sambucus canadensis L.	American elderberry
Smilax hispida Muhl.	bristly greenbriar
Spiraea arguta Zab.	garland spirea *
Ulmus americana L.	American elm
Ulmus pumila L.	Siberian elm
Ulmus rubra Muhl.	slippery elm
Viburnum dentatum L.	arrowwood viburnum *
Vitis sp. L.	grape

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APPENDIX I

CIYC3 1133-37?

Restoration of Native Grassland at Homestead National Monument

By

Wildlife Technician Adolph Murie

The Homestead National Monument, which consists of the first homestead filed, lies about 5 miles from Beatrice, Nebraska. Its size which is that of the usual homestead in this area, is 160 acres. A small creek bordered by trees flows through the area and a highway cuts across a portion of it. There is undoubtedly more woods present now than originally, due either to planting or natural spread made possible by the cessation of prairie fires. The fields have been under cultivation until recently.

E. A. Hummel, Regional Historian is making plans to restore the conditions on the homestead as they were when the homesteader, Mr. Freeman, first settled on it. Among other things, Hummel wishes to restore the native vegetation so far as that is possible, and we have discussed this phase of the picture a number of times, and on February 3 discussed it with Dr. Weaver of the University of Nebraska. From the wildlife standpoint, the restoration of the prairie in the area as an aid to establishing the early historical picture seems very much worthwhile. In carrying out this proposal no doubt much could be learned about the prairie habitat. Any information concerning prairie restoration is of special importance today because of the large amount of grassland under agriculture which should never have been plowed, and which will eventually probably be restored to grass.

The homestead lies in the tall grassland region which includes the eastern one-third of Nebraska and continues eastward over Iowa and into Illinois. When the homesteaders first came into the country the grasses were so tall in places that they hid the stock, making it sometimes difficult to find the cows and horses. Some of the grasses grew to a height of ten feet.

Description of Prairie Habitats

In the area where the homestead lies there were several grass species which were assorted and grouped in a more or less definite manner, depending upon the slope of the hill, exposure, soil moisture, aeration of soil, and other factors.

Six Important Prairie Habitats:

In moving from the wet to the dry habitats in the prairie the following plant types occurred:

1. Very wet habitats contained the sedges: (Carex vulpinoidea, Carex hystricina), and the rushes, one of which was Scirpus atrovirens.

2. Wet, poorly aerated habitats frequently saturated: Slough grass (Spartina michauxiana) was the dominant grass.

3. Intermediate lowland habitat, slightly less moist than the previous habitat. It occurs on soils where conditions are intermediate between those occupied by slough grass and big blue stem. Where the land slopes gradually this belt is sometimes broad but where the slope is more abrupt there is only a narrow belt of this type. The principal grasses are tall Panic grass (Panicum virgatum), and nodding Wild Rye (Elymus canadensis). The herbs in this habitat are similar to those found with Spartina.

4. Well aerated lowland type of habitat. This habitat was dominated by the Big Bluestem (Andropogon furcatus) and was one of the two most important types on the prairie. It occupied the broad lowland valleys of the larger streams in the true prairie association. It is best developed on lower moist slopes and well aerated lowlands and was in practically complete possession of them.

5. Upland type of habitat. This habitat occurs on lands slightly drier than that occupied by Big Bluestem. The dominant grass in this habitat is Little Bluestem (Andropogon scoparius). In the prairie region this species dominates an area very much larger than that occupied by Big Bluestem. It ordinarily forms an interrupted sod, the mats or tufts being so dense that few other species can invade. Accompanying species grow between the mats. On drier steep slopes there is a tendency for this grass to grow in bunches. Its seedlings are vigorous and tiller both early and abundantly. Flower stalks are produced in abundance only in wet years or in more favorable situations.

6. Dry upland type. On the drier areas such as hilltops and in sandy thin soils Needle grass (Stipa spartea) is the chief dominant. The chief associates are bluestems and June grass (Koeleria cristata).

Prairie Habitats on the Homestead Monument

As I recall the Homestead area, I would judge that there were principally two habitats present. The well aerated lowland type occupied by Big Bluestem (Andropogon furcatus) and what I have called the upland type occupied by Little Bluestem (Andropogon scoparius). The former on the lower ground, the latter on the higher part of the Homestead. It is possible that the entire area was occupied by one or the other of these types, and after a close examination it may be found that a little of the wet habitat occupied by Slough grass is present. The wet habitat will probably if it is present be occupied by vegetation now and will probably not be represented in any of the open fields which have been cultivated.

I believe we can go on the assumption that the higher portions of the homestead were occupied by Little Bluestem and the lower portions by Big Bluestem. If plantings are made on this basis we will give both types an opportunity to become established. If the whole area is adapted to one or the other of these types a natural adjustment will probably be made over a period of years. Also if both types belong on the area the extent of the area each type should occupy should become automatically adjusted in time. If future study shows that Needle grass or any other type is a normal type for the area it can later be restored.

Besides the grasses in the prairie there were many herb species present. Some of these herbs bloomed in the spring and others bloomed through the summer and in the fall. The herbs of early spring were small, completing their blooming before overshadowed by the grasses. The flowers that bloomed in the fall were tall, as tall as the grasses or taller. In restoring the prairie grasslands the ultimate aim is to approach as near the original as possible. How near the original we can come is not known. But it would seem desirable to make an effort early in the program to restore some of the more prominent spring, summer and fall flowers to show a part of Nature which no doubt gave some cheer to the first settlers.

Examples of spring and early summer flowers are: Antennaria campestris, Erigeron ramosus, Psoralea argophylla, Fragaria virginianum, Baptisia leucophaea, Echinacea pallida, Sisyrinchium angustifolium, Galium tinctorium. Examples of later summer and fall flowers: Helianthus rigidus, Aster multiflorus, Asclepias tuberosa, Liatris punctata, and Liatris scariosa.

Suggestions for Program of Prairie Restoration

To restore the prairie two methods can be used and perhaps both should be tried. The best method is to secure the prairie sod from doomed prairie areas and transplant them on the area. Mr. Weaver thought that original prairie sod could be purchased in the vicinity of the Homestead and was in favor of using this method of restoration. Since some of these relict areas are rather certain to be destroyed it is felt that we would be justified in using part of one for our purpose. In grafting the prairie sod there is a special advantage in that not only is prairie grass brought into the area but also native species of prairie herbs. The sod should probably be restored in several patches scattered over the area, not all in one place. This would permit a more rapid spread of the prairie species over the area. I am not sure how large each sod patch should be but possibly 15 or 20 yards or a little more, in diameter should be the minimum. Care should be taken to have a sufficient nucleus in each patch so that a healthy growth would be assured. The sod should be placed at various elevations, the Little Bluestem sod on higher ground, and Big Bluestem sod on the lower ground. South exposures dry out faster than other exposures so that it may be well to avoid placing the sod on south exposures if others are available and the supply of sod is limited. Before bringing in the sod the fields probably should be plowed and harrowed.

Since it is likely there will not be sufficient sod available to cover the area, parts not covered by sod could be sown with grasses, Big Bluestem grass on the lower ground, Little Bluestem on the higher ground. Various prairie herbs can be planted with the grass, or later be brought into the area. Caution should be used, however, in planting herbs for certain species are aggressive and may tend to compete too strongly with the grasses before the latter become established.

Some shrubs such as Amorpha canescens, Rosa arkansana, Ceanothus pubescens, Salix humilis and Rhus rydbergii were part of the prairie and should also be restored in their proper habitat. The shrubs could be brought in after the grass is established.

Cooperation with University of Nebraska

Dr. J. E. Weaver of the University of Nebraska has been carrying on studies of the prairie for over twenty years. He is the outstanding authority in this field. In our efforts to restore the prairie at Homestead his advice should be obtained whenever possible. When we discussed the project with him he was very enthusiastic and thought that it was very worthwhile. Although it would be difficult, especially by means of seeding, to restore the original prairie because of the intricate balance of plant groups within the prairie, Dr. Weaver felt that a fairly good job of restoration could be made even by the seeding method, and that as time went on adjustments would occur among the plants which would bring the grass community nearer and nearer to the original prairie. He suggested that sod be brought in and as above stated knew where sod could probably be obtained. Dr. Weaver felt that the project contained the possibilities of an excellent experiment and expressed an interest in being rather closely associated with the project. It would be desirable to make it possible for him to assign a graduate student to carefully supervise the restoration. Such an arrangement would give the best assurance to the success of the undertaking for Dr. Weaver's supervision would be the very best anywhere available. As a guide in the work the best publication is "The Prairie," by J. E. Weaver and T. J. Fitzpatrick.

Recommendations:

1. That a fence be built around the area to prevent the trespass of hogs and other livestock.

2. That the fields be plowed and made ready for seeding and sodding.

3. That original prairie sod be purchased and transported to the homestead.

4. That the part of the area not sodded be seeded to Big Bluestem on the lower ground, Little Bluestem on the higher ground.

5. That some attempt be made to get Dr. J. E. Weaver's close cooperation and supervision of the work.

HOMESTEAD NATIONAL MONUMENT
BEATRICE, NEBRASKA

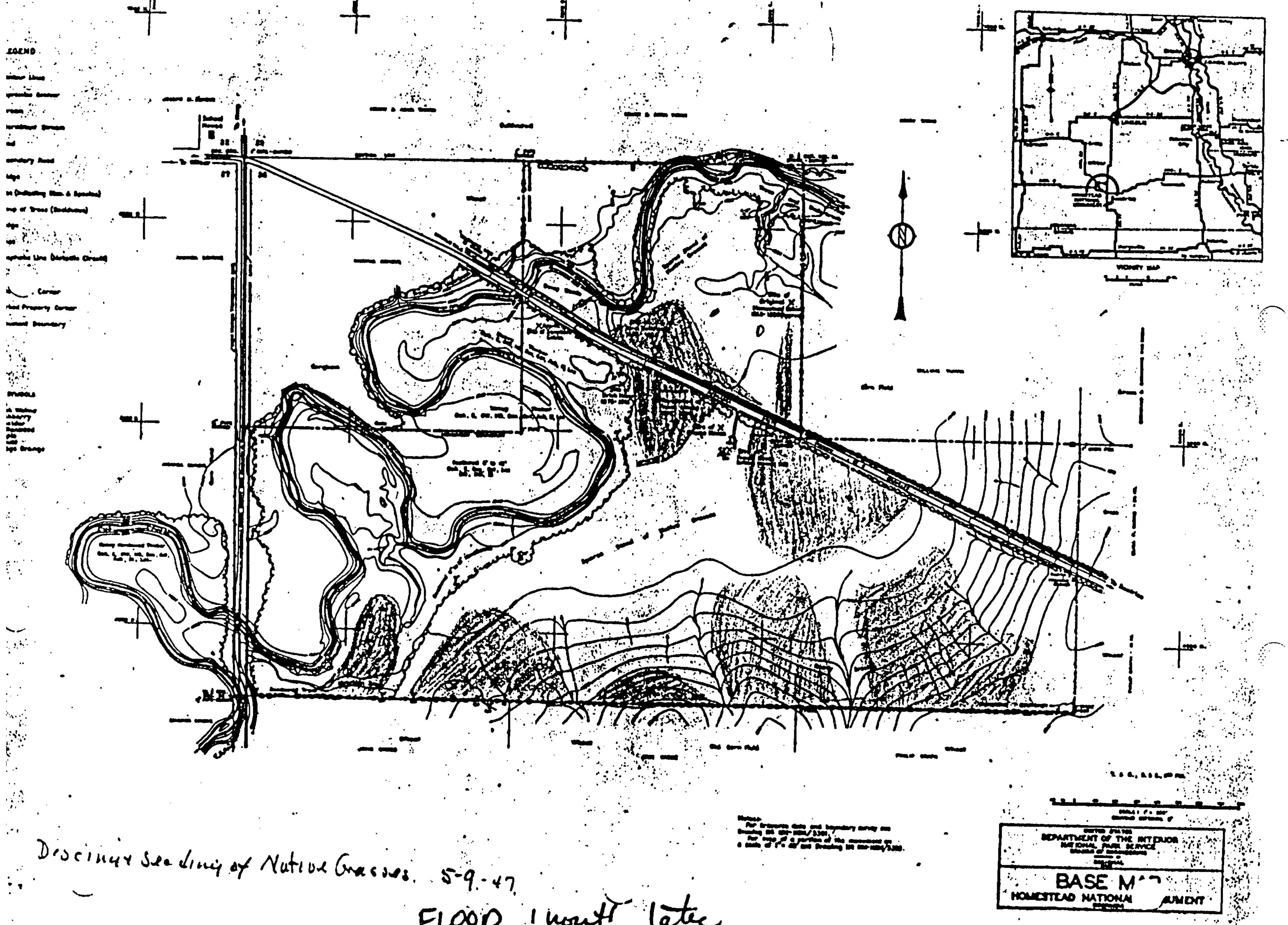
March 20, 1947.

Unless other native grass seed is available in the Omaha market it is suggested that 200 pounds of blue stem seed be procured from the Peppard Seed Co., Kansas City, Missouri. It may be recalled that the Peppard Co. wasthe vendor of the seed sown as a part of the 1940-1941 ERA project.

A requisition covering the purchase is attached.

Clarence H. Schultz,
Custodian.

Enclosure.



Discing & Seeding of Native Grasses. 5-9-47.

FLOOD 1 month later

Office Memorandum • UNITED STATES GOVERNMENT

TO : C. H. Schultz, Superintendent, National Homestead Monument, Nation Park Service, Beatrice, Nebraska

DATE: July 20, 1951

FROM : E. J. Dyksterhuis, Regional Range Conservationist, SCS, Lincoln 1, Nebraska

SUBJECT: Cooperation National Park Service - SCS

You asked if I would write down the recommendations we discussed on our July 6 field trip over the monument. I now have an opportunity and my notes on the visit follow:

General Recommendations

1.) That no grazing by domestic livestock be permitted. This because it will delay or prevent restoration of True Prairie vegetation which is the climax, or original, or indigenous or virgin type of vegetation for the area.

2.) That any mowing, done around margins and along travel-ways for hay, be done before July 15.

3.) That any clipping of weedy areas, done to hasten establishment and full occupancy by climax species, be done when the first heads of the annual brome grasses are being exserted from their sheaths.

4.) That Kentucky bluegrass be encouraged in picnic and similar areas where the native mid and tall grasses of the True Prairie would be inappropriate. This can be done by frequent mowing. Also, in such areas the chemical herbicides such as 2-4-D are appropriate. Fertilization may eventually be necessary for maintenance of good bluegrass turfs where foot traffic is heavy.

5.) That chemical herbicides not be used in prairie areas because they kill many species of native forbs which add much color and interest to the climax prairies as well as adding nitrogen to the soil in the case of the legumes.

6.) That native prairie forbs be encouraged, particularly those native legumes that already may be observed spreading from isolated parent plants now in the area. Among these are:

the scurfpeas (Genus Psoralea)
the tickclovers (Genus Desmodium)
the prairieclovers (Genus Petalostemon)
the wildindigos (Genus Baptisia)
the native lespedezas (Genus Lespedeza)
the milkvetches (Genus Astragalus)
& the amorphas, particularly leadplant (Genus Amorpha)

The foregoing legumes are all perennials, natives, and somehow again present locally; even though the area was once cultivated. They may be aided in reassuming their natural role in this kind of vegetation by transplanting specimens into the larger areas of reseeded bluestem grasses where they are not now present.

7.) That lowland stands of native little bluestem, big bluestem, switchgrass, and Indiangrass be supplemented with other native species which are characteristic of lowland prairie but which were not present in the seed mixture used to restore prairie on these lowlands. In very weedy lowlands with poor perennial grass cover this may be accomplished by introduction of seed-hay from comparable lowlands with climax vegetation. In the wettest lowlands with moderately good stands of the native species mentioned, we recommended introduction of sod-chunks or rhizomes of such native tall growing species as:

Prairie cordgrass (<u>Spartina pectinata</u>)
Gamagrass (<u>Tripsacum dactyloides</u>)
Maximilian sunflower (<u>Helianthus maximiliana</u>)
& species of <u>Silphium</u>

8.) True Prairie and fire hazard go together. There can be no true prairie without a fire hazard, however, true prairie evolved with occasional fires so an occasional accidental fire now tends to simulate normal conditions.

<u>S. W. Bottom Area</u>

This area where a seeding of switchgrass failed and many weedy perennials have volunteered, should be clean-tilled and seeded to some domesticated crop which will leave a good stubble or mulch into which a lowland native mixture can be introduced. Either the seed-hay method or drilling may be used. Seed-hay from a comparable local area of climax or near climax lowland vegetation would insure a good mixture as well as thorough adaptation of all species to your site conditions.

<u>East 40 Eroded Hillside</u>

Three possibilities for improvement appear feasible:

1.) Application in early spring of commercial fertilizer, including particularly about 60 lbs. of nitrogen per acre.

2.) Mulching bare eroded spots with seed-hay or manure.

3.) Clipping once during the first week in July with sickle-bar [illegible] high. This with the thought that the sickle-bar would [illegible] some mulch over bare spots and would also encourage lateral spread in the present clumpy condition of the grasses.

<u>Deposition of silt from outside Field on South</u>

The area of deposition will always contain annual and other weeds. Mowing this area may decrease the height of the weeds but would not decrease the perimeter of the weedy area. We recommend no mechanical treatment and instead depending upon natural competition from unmolested surrounding native vegetation to limit the weedy area to the smallest possible perimeter.

I enjoyed very much going over the monument with you and Messrs. Smedley and Clymer. I wish to thank you again. I'm glad the three of you have long worked together on this. If questions arise in connection with this memo, do not hesitate to call on them.

cc: Lee E. Smedley, D. C.
Pawnee City, Nebr.
J. A. Clymer, WUC
Beatrice, Nebr.
Nebraska State Office

Office Memorandum • UNITED STATES GOVERNMENT

TO : J. Dexter Haws, Work Unit Conservationist, Beatrice, Nebraska.

DATE: September 6, 195

FROM : L. G. Wolfe, Agronomist, Lincoln, Nebraska.

SUBJECT: Homestead National Monument

Part of the morning of September 6 was spent with Harold Gilman and Mr. Blake at the Homestead National Monument. Mr. Blake asked us certain questions concerning weed control and re-seeding on the Monument grounds. The following are my suggestions in answer to his questions:

1. Sweet Clover is scattered through the native grass area. This could develop into one of the more serious weeds and it was suggested that it be sprayed with 24D each year in May or early June until control is effected. The sweet clover should be sprayed in patches only in order to save as many of the native legumes as possible.

2. Smooth Brome Grass is prevalent in one field occuring with the desired tall native grasses. It was suggested the brome could best be controlled by mowing the latter part of May and the hay permitted to remain on the ground to provide a mulch so that native grasses would be encouraged.

3. Sparse patches of tan weed and annuals were not thought to be serious. It is believed that where the native grass is not mowed or grazed these weeds will eventually disappear.

4. There are only a few native legumes now present. It was suggested that no weed control be used that would eliminate the native legumes in the bulk of the area.

5. There are a few low areas where water stands. At present these are mostly in tan weed and kentucky blue grass. It was suggested that next spring some spot sodding be done with prairie cord grass. Since these sites are more nearly suited to cord grass rather than blue stems.

6. [illegible] along the creek and where run off from adjacent cropland occurs will present more of a problem. It was suggested that here again prairie cord grass would be the only native capable of withstanding silting. It was also mentioned that some of these areas might be ideal locations for sumac, wild plum, choke cherry and other native shrubs.

7. For the most part seeded areas contain good competition of climax species. Future seedings should not contain seed of buffalo grass nor blue grama.

cc: E. [illegible]. Saylor

D5415

RECEIVED
SEP 17 195_

SEP 16 1955

Memorandum

To: Superintendent, Homestead National Monument

From: Acting Regional Chief of Operations

Subject: S&MC - Agronomist Wolfe's report

The report made by Agronomist L. G. Wolfe of the Soil Conservation Service to the Work Unit Conservationist of Gage County, Nebraska, as transmitted with your memorandum of September 14, has been received.

Mr. Dickison has reviewed Mr. Wolfe's interesting report and offers the following comments concerning each item of the report, which are based on frequent observations over several years and supplement Mr. Wolfe's remarks:

1. Sweet clover is a legume. Although not native to the area, it has provided a valuable nitrogen fixation process that has aided the reestablishment of native grass in the field areas. For the past several years sweet clover has only been observed at random in the field areas and has not dominated any site to any extent. It was originally planned to eradicate the clover when a climax or high sub-climax stage of the grass had been reached. In view of Mr. Wolfe's comment, you may wish to make frequent observations of the extent of the sweet clover and ascertain if it is dominant in any site. Should it appear to be dominant and suppressing desired grasses, it should be eradicated promptly along the lines suggested by Mr. Wolfe.

2. The smooth brome grass mentioned by Mr. Wolfe as being prevalent in all field areas is believed to be gradually going out as it has been crowded by Little Blue Stem throughout the perimeter of the stand. While Mr. Wolfe does not state where he observed the smooth brome grass, we believe the only stand of any extent is directly east of Cub Creek in the North "40" of the monument area. Should it be desirable to hasten the ecological process whereby the smooth brome is being replaced by the Little Blue Stem, the mowing during the middle of May or early May may prove a little more effective than the latter part

of May as suggested by the Agronomist. This, of course, should be governed by the seed head development and number of florets or individual seeds by stalk.

3. The tarweed and annual weeds mentioned in the report are indigenous to the area and should not present a problem now or in the immediate future.

4. While there are only a few native legumes present, it has been less than five years since there were no native legumes discernible in the field areas. It is encouraging to note the number now present and it is believed with continued protection that they will increase in numbers and prove a valuable component of the grass stand.

We have always cautioned against the indiscriminate use of chemicals in weed control and where such weeds as bindweed, horse nettle, and others, require chemicals as the only feasible and economical method of control, some native legumes are lost. However, the benefits of such control far outweigh the loss in this respect.

5. The suggestion concerning prairie cord grass (Spartina pectinata) is well taken. Should it be possible to locate a stand of cord grass in the vicinity of the monument, it would prove most beneficial to secure a number of clumps and spot sod the low water collecting areas.

6. The water ways draining adjacent crop land, particularly to the south of the monument, were all gullies and actively eroding during the early stages of monument development. We agree with Mr. Wolfe that here again prairie cord grass offers the best solution. We do not, however, feel that sumac and wild plum can ever successfully be maintained in these sites unless the agricultural practices carried out on the adjacent fields are of the highest type and a considerable amount of water retention is made in these areas.

7. We agree with Mr. Wolfe that good competition exists in the present species. We believe, however, that the area originally possessed a representative stand of mid grass or tall grass species. We have never advocated the use of buffalo or blue grama grass in such types.

As the grass lands reach a climax it will be interesting to note the succession that will take place. In all probability, the stand will be relatively stable unless utilization or abuse of some sort influences the stand.

Mr. Wolfe's report is very comprehensive and quite analytical, especially considering the short period of his visit. We found it most interesting and we are sure it will prove of value in your grass managing problem. We appreciate the interest expressed by these technicians in our future program of having the area entirely restored to native grasses.

(Sgd) William E. Robertson

William E. Robertson
Acting Regional Chief of Operations

✓In duplicate

D54

July 26, 1956

Memorandum

To: Acting Regional Chief of Operations

From: Regional Soil Conservationist

Subject: Field Trip Report, Homestead National Monument

A one day trip was made to Homestead National Monument July 20 for the purpose of assisting the Superintendent with Soil and Moisture Conservation problems and weed control needs.

The trip was made in company with Assistant Regional Director Malbourne M. Harvey. Mr. Harvey reviewed the general operations of the Monument.

General

A brief review was made of the major grass types with Superintendent Shaver. The Monument has made some remarkable recovery during the last several years as regards soil cover compared with the land and related vegetative condition that existed prior to the completion, some three years ago, of the initial Soil and Moisture Master Plan. Some very desirable species of indigenous grasses and legumes are much in evidence at this time. This natural vegetative condition is rapidly becoming a rarity in this section where agricultural activities have concentrated on row crops, cash crops, or rotation cropping systems that include production of small grains, cereal crops, or development of pasture with grasses of exotic or adventitious species.

Project Areas

The initial Soil and Moisture Conservation Master Plan concentrated principally on gully erosion control, land conversion, and stream bank stabilization activities. It appears of the three activities, the land conversion work, with few exceptions, was the most successful. The few exceptions to complete land conversion include the existence of two small sites infested at this time with Bindweed (Convolvulus arvensis). This weed has been classified as Nebraska's most noxious weed and, in view of the agricultural activities adjacent to the Monument, it should be eradicated completely from the Monument area. The application of herbicides will eventually eliminate this Bindweed, however, two to three sprayings per season will be necessary for several years in the infested sites. Other weeds, exotic or noxious, at this time include: Lambsquarters (Chenopodium album), Kochia (Kochia scoparia), Horse Nettle (Solanum carolinense), Mayweed (Anthemis cotula), Bull Thistle (Cirsium lanceolatum), Canada Thistle (Cirsium arvense), Erect Knotweed (Polygonum ramosissimum), and Giant Ragweed (Ambrosia trifida) have a scattered distribution in the area. Most of these weeds, with the exception of two or three, will give way in time to the native grasses and legumes. However, there still remains the need to eradicate, because of their extremely noxious character, the following: Thistle, Ragweed, and Horse Nettle along with the Bindweed from the Monument area.

The second remaining Soil and Moisture Conservation need concerns more complete stream bank stabilization along the course of Cub Creek in the Monument. Initially, some seven sites were planted with Willow cuttings as a bank stabilization measure. Most of these plantings survived and are doing an effective job of stabilizing the stream's course at the planting sites. Some minor beaver damage has been inflicted on several established Willow sites, however, this appears to be of little concern to the ultimate bank stabilization as it is anticipated that additional sprouting will occur almost as fast as damage is inflicted at these sites. In several instances, the original plantings should be extended or enlarged to further stabilize the stream's course. Using the original Willow plantings as a source of supply, cuttings for additional plantings would greatly benefit the entire stream course.

The Monument area originally supported a fine stand of Little Bluestem (Andropogon scoparius) and other species typical of the tall grass prairie. This species, with the exception of about 3-4 acres, occupies the entire grass land area as the dominant grass species. The 3-4 acres are occupied currently by Smooth Brome (Bromus inermis), a desirable grass although of exotic origin. It is believed, with the practice of one mowing of the 3-4 acres during late May or early June, as the seed starts to mature, this Smooth Brome grass will give way rapidly to the warm season grasses such as Little Bluestem, Switch Grass, and other native species that are now considered subclimax from an ecological standpoint in this site.

Summary

Superintendent Shaver indicates a deep concern for maintaining the best possible soil condition, natural vegetative cover, and stable land for the area. He would like to see all lands of the Monument at the highest possible degree of stability prior to celebration of the anniversary date of the Monument. Should it be desired to obtain these objectives, an increase in the Monument's Soil and Moisture Conservation Program, over the maintenance activities presently being carried out, would be necessary.

The Soil and Moisture Conservation work now being carried out, with a very small allotment, only permits the completed work program to remain effective. To further improve the land resources, as now desired, would require an estimated $3000 to be used over approximately a three year period. Such a program would permit additional Willow plantings, accelerated weed control activities, and more rapid conversion of the entire area to a vegetative condition compatible with the Homestead area.

There are now several signs depicting the grass stand for interpretive purposes. The Monument plans to improve these signs somewhat this fiscal year along with the general sign program for the area made possible by the $2300 item for signs during the 1957 fiscal year.

(Sgd) Fred F. Dickison

Fred F. Dickison
Regional Soil Conservationist

Copy to: Mr. Baker
Mr. Harvey
✓Homestead NM

Concurred in by: (Sgd) L. R. Brown Date: JUL 27 1956
Acting Regional Chief of Operations

Approved for Distribution: (Sgd) Chester C. Brown Date: JUL 27 1956
Acting Regional Director

D 54

Homestead National Monument
Beatrice, Nebraska

October 28, 1957

Mr. Calvin McMillan
University of Nebraska
Lincoln, Nebraska

Dear Mr. McMillan:

Shortly after you left the area, we checked the old Job Sheets of the E.R.A., numbered from 1 through 22, which was the original Soil Conservation work. These projects vary from signs and markers to landscaping, undifferentiated. There was some question as to the source of seed used in the reseeding projects at Homestead. We find that considerable sodding was done and that the reseeding listed under Job No. 4 consisted of planting native seed harvested locally. We quote in detail the information copied from the Job Application record on Form 715, Job No. 4, Master Plan 2501 under the date of May 2, 1939:

Justification

"This job provides for the seeding with native grasses that portion of the Homestead National Monument which previously was under cultivation. The $270.00 requested for material covers the cost of native grass seed. The seed that will be used was harvested in the vicinity of Gage County, Nebraska. It is planned to use from 15 to 20 lbs. per acre. All seeding will be done by hand labor.

Native grass seeds are not separated into species. The mixture which will be used for this area will contain about 45% Big Bluestem (Andropogon furcatus), about 50% little Bluestem (Andropogon scoparius), about 1% needle grass (Stipa spartea), 1% bluegrass (Poa pratensis), 1% prairie dropseed (Sporobalus heterolopsia), 1% Indian Grass (Sorghastrum nutens), and 1% side oats grama (Bouteloua curtipendula).

The local Soil Conservation camp is supervising the planting of this seed. They plan to follow the recommendations outlined in a bulletin recently published by the Soil Conservation Service, entitled "Native and Adapted Grasses for conservation of soil and moisture in the Great Plains and Western States", Department of Agriculture Farmers, Bulletin #1812."

We find no reference to early records of seed being purchased, other than local.

Yours very truly

Ralph K. Shaver
Superintendent

MASTER PLAN

VEGETATIVE MANAGEMENT

OF

HOMESTEAD NATIONAL MONUMENT

****

Volume III, General Monument Information
Section K. Vegetative Management

****

Prepared by: Fred F. Dickison, Regional Soil Conservationist — Date: 7/8/60

ACCEPTED BY: Warren D. Hotchkiss, Superintendent — Date: 7/11/60

June 1960

PRESERVATION AND MANAGEMENT OF VEGETATION

I. Objectives

The objective will be to manage and preserve the vegetation so as to recreate and maintain as far as possible conditions which prevailed during the period when Daniel Freeman first homesteaded this area. The vegetative cover on south three forties will be maintained in a natural state to approximate the year 1863, when Daniel Freeman actually began his homestead activities.

II. Vegetative Types and Conditions

1. Types. Two broad vegetative types occupy the area--Grassland and Forest. Both types are in a thrifty condition and are adaptable to simple management practices.

A. Grasslands.

Tall-grass prairie is the major vegetative type of the Monument area. This type occupies 62% or 100 acres of the land area of the Monument.

Dominant species of grass are:

(a) Big Bluestem (Andropogon gerardi), Switchgrass (Panicum virgatum), Indian grass (Sorghastrum nutans), and to a lesser extent some Little Bluestem (Andropogon scoparius), along with a minor patch of Smooth brome (Bromus inermis).

(b) Flowering plants include Ashy sunflower (Helianthus mollis) and Half Scrub Sundrop (Oenothera serrulata). The more prominent forbs include Coll gayfeather (Liatris scariosa) and Yucca leaf Yarrow (Eriogonum yuccifolium). Desirable legumes include Round head Lespedeza (Lespedeza capitata), Slender Lespedeza (Lespedeza virginica) and others of occasional occurrence which include Heath Aster (Aster ericoides) along with a few stalks of wild alfalfa (Psoralea tenuiflora). The forbs and legumes play a minor role in the grasslands. Although they are not prominent, they do indicate a well-stocked grassland. When in flower they add a pleasant appearance to sections of the grass stand at various times throughout the growing season.

B. Woodland.

The woodland area is composed almost entirely of hardwoods. This stand occupies some 38% or 60 acres of the total area and is principally distributed along the banks of Cub Creek. This wooded stream course meanders for approximately 1½ miles through the Monument.

An occasional Eastern Juniper (Juniperous virginica) occurs in the hardwood stand. Juniper seedlings continually attempt to invade the grassland area from these few specimens of Junipers.

Principal species of the wooded section are Oaks, predominately red (Quercus ruba) with some white (Q. alba) and Bur Oak (Q. macrocarpa); Silver Maple (Acer saccharinum); American Elm (Elmus americanus); hackberry (Celtis occidentalis); and some large individual specimens of broadleaf cottonwood (Populus sargentii).

The wooded area contains a few small seedling and sapling size black walnuts (Juglans nigra).

An Osage hedge grows along the south boundary of the south and east forty. This Osage orange was planted after the section was settled sometime during the 1880's.

Stands of willows grow immediately adjacent to the stream proper. They were planted to stabilize the cutting and crumbling stream bank and have thrived at a number of sites despite the activity of beaver.

2. Condition

A. Grasslands.

Prior to the area being established as a Monument only a sparce stand of native grasses existed. Since protection has been afforded, there has been a notable increase in the stand, both as to species and vigor. The grass stand now approximates that which was present during the period of 1863 when Daniel Freeman first homesteaded the area.

B. Woodland.

The trees in the wooded section are of uneven age and mixed species. The forest is considered to have approximately the same composition as existed at the time of settlement by Daniel Freeman. Lately, however, a few specimen seedlings of Black Walnut are gradually being reestablished in the wooded section; prior to establishment of the Monument all walnut trees of high commercial value were cut.

III. Management Practices

Management practices should focus toward maintaining the thrifty condition of the vegetation while at the same time depicting the scene as closely as possible to that which prevailed during the settlement era. Maintenance of the thrifty condition requires protection from fire, no grazing, and treatment against insect attacks and disease. Exotic species should be excluded and practices should be avoided which would tend to make the general appearance of the vegetation unnatural or influenced by man.

1. Grassland

The grassland at this time approximates that which existed at the time Freeman first homesteaded the four quarters of land, with the exception of a few species which are being eradicated. One of these species is Smooth brome (Bromus inermis). Smooth brome occupies a small section in the north forty in the northeast corner. It was established just prior to acquisition of the area for Monument purposes and has successfully competed with the native grasses for some twenty years.

Eradication of Smooth brome involves mowing during the early spring season to prevent reseeding. This clipping tends to decrease its ability to withstand competion from the native grasses and in time will be replaced by indigenous species.

Eradication of exotic weeds is a continuing management need. Exotics now being eradicated include Bindweed (Convolvulus arvensis) which has spread from neighboring field areas. Canadian thistle (Cirsium arvense) control should continue in the south and southwest forties until eradicated. Other weeds requiring a continuing eradication effort include annual sunflower (Helianthus annus) and thistles (Cirsium Lanceolatum).

2. Woodland

Management practices for the woodland consist of protection. Fire, insects, and tree diseases are the principal threats.

Prominent weeds in the wooded area, by order of distribution or occurrence, are Giant Ragweed (Ambrosia trifida); Foxtail grass (Setaria viridis); and Horse Nettle (Solanum carolinense). All are controllable by herbicides. Control must be continued indefinitely because flooding along Cub Creek continually deposits new seeds from the upstream watershed.

IV. Maintenance Requirements

1 Grassland:

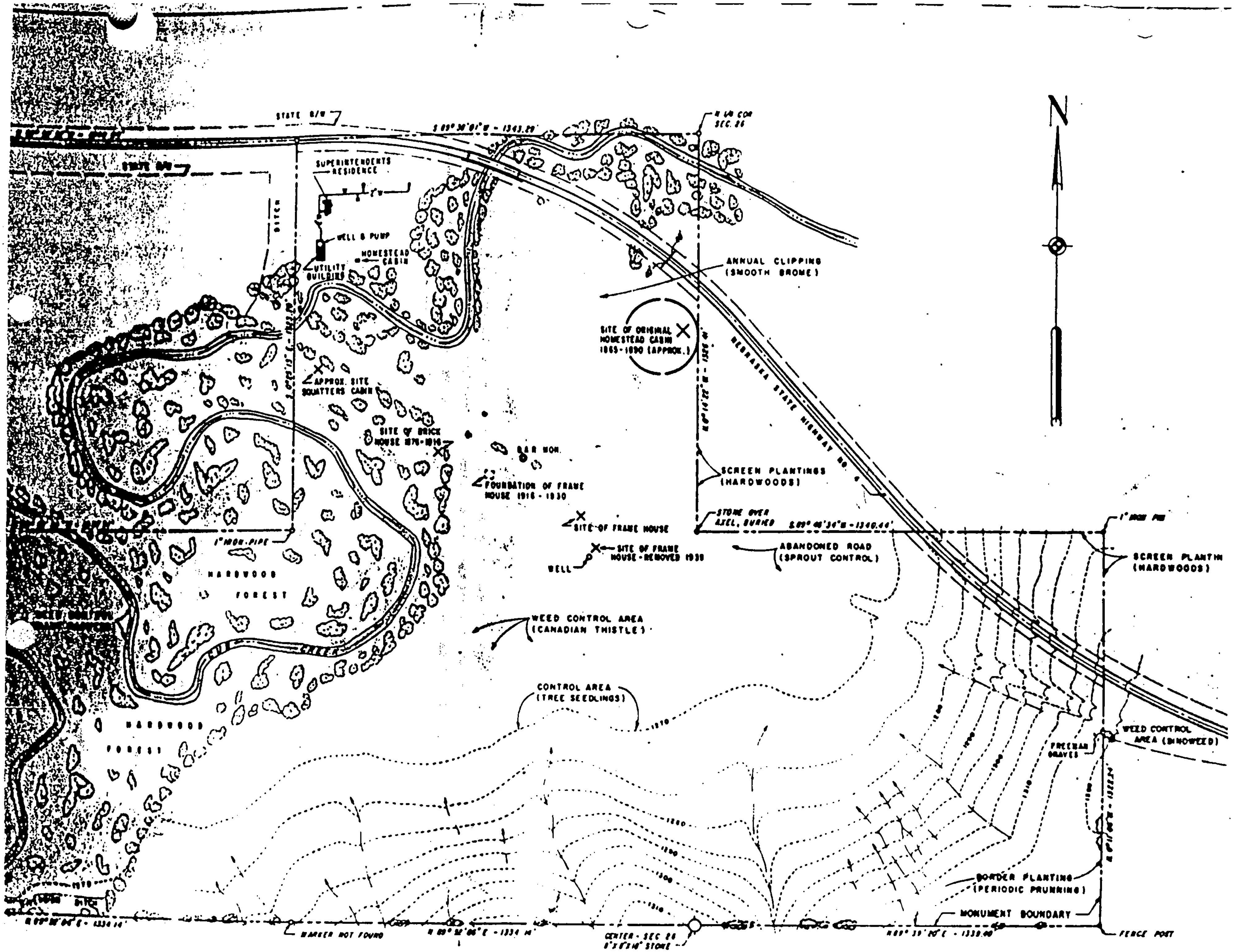
Maintenance of the grassland and retaining the aspect which prevailed during the Homestead era requires periodic removal of excess grass. It should be mowed every third to fourth year, depending on moisture and growing conditions. Removal of the excess grass will encourage the stand to maintain a condition which coincides with the homestead era when the grasses were periodically reduced by buffalo, and the infrequent sweep of prairie fires. Mowing should be confined to the sections where the soils are deep, avoiding the gentle slopes and drainageways which were once seriously eroded but now are stabilized by firm sod. Only one cutting during any one growing season should be made.

The period for cutting, depending on stage of maturity of grass, fire danger, prevailing weather, and other factors, will usually fall between July 20 and August 20. In occasional years, when the grass is not to be mowed otherwise, it may be possible to harvest the seed heads of the Big Blue Stem grass.

2. Woodland

Protection alone, without the need for reforestation, should suffice to permit the wooded area to continue to thrive. There has been some damage by beaver to willow stands along the course of Cub Creek. It may occasionally be necessary to supplement remaining stands of willows by planting cuttings from the stands of existing willows.

The Monument is located in a section of Nebraska that is primarily agricultural and close cooperation must be maintained with adjoining land operators and numerous conservation groups, all having interest in the area's land and its related resources.



N
STATE R/W
SUPERINTENDENTS RESIDENCE
WELL & PUMP
HOMESTEAD CABIN
UTILITY BUILDING
APPROX. SITE SQUATTERS CABIN
SITE OF BRICK HOUSE 1876-1916
B & R MON.
FOUNDATION OF FRAME HOUSE 1916 - 1930
SITE OF FRAME HOUSE
SITE OF FRAME HOUSE - REMOVED 1938
WELL
HARDWOOD FOREST
1" IRON PIPE
ANNUAL CLIPPING (SMOOTH BROME)
SITE OF ORIGINAL HOMESTEAD CABIN 1865-1890 (APPROX.)
NEBRASKA STATE HIGHWAY NO. 4
SCREEN PLANTINGS (HARDWOODS)
STONE OVER AXEL, BURIED
ABANDONED ROAD (SPROUT CONTROL)
SCREEN PLANTIN (HARDWOODS)
WEED CONTROL AREA (CANADIAN THISTLE)
CONTROL AREA (TREE SEEDLINGS)
WEED CONTROL AREA (BINDWEED)
FREEMAN GRAVES
BORDER PLANTING (PERIODIC PRUNNING)
MONUMENT BOUNDARY
FENCE POST
CENTER - SEC 26
MARKER NOT FOUND

Homestead National Monument
Beatrice, Nebraska

~~N3015~~
N50

April 2, 1963

AIRMAIL

Memorandum

To: Director

From: Superintendent, Homestead

Subject: Toxic Chemicals

The following information is submitted for Homestead National Monument in accordance with Mr. Price's memorandum of March 7.

During the past several years in both the Soil and Moisture and Forest Pest Control programs at Homestead, we use chemical spray to combat noxious weeds and plants. This type of control has proved very effective in both the prairie grassed area of the Monument and in the timbered area along Cub Creek. This spraying is usually done once a year in the early Spring in the areas mentioned.

The chemical used is 2-4-D-5, No. 5 (Ester) - 4# of 2-4-D per gallon for fast weed killing action. This chemical is mixed with water in a 50 gallon drum and applied with a tractor operated mist spray attachment in the prairie grass area, and with a hand sprayer in the timbered area of the Monument along the banks of Cub Creek. During 1962 twelve gallons of the above chemical was used at Homestead.

No side effects have been observed on either fish or wildlife at Homestead, and no personal injuries have resulted during application of the chemical.

Weed control is a continuing project at Homestead, and it is anticipated that chemical spraying each year in the early Sprin as one of the methods of combat, will be necessary in the years to come.

Warren D. Hotchkiss
Superintendent

In duplicate

Copy to: Regional Director, Midwest Region

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
MIDWEST REGION
1709 Jackson Street
Omaha, Nebraska 68102

FEB 4 '65

Superintendent
Historian
Adm. Ass't.
Clerk-Typist
Caretaker
File

IN REPLY REFER TO:
D54-MWR (ORM)
xY46

FEB 3 1965

Memorandum

To: Superintendent, Homestead

From: Forester

Subject: Mowing the prairie, Homestead

Your memorandum of January 15 advises of your plans to have the entire prairie mowed in June of this year and have the hay produced removed accordingly. While this proposal is in line with the Vegetative Management section of the Master Plan for Homestead, it should also be noted such plan indicated no mowing would be accomplished in the stabilized erosion areas. These areas are outlined with the designation S.E.A. on page 6 of the Master Plan, approved July 18, 1962, and these sites had received special attention to regain soil stability. We are aware of the excellent progress which has been made in re-establishing native grasses in the area. We assume your reference to sod-bound and loss of vigor of the grass stand applies principally to the dominant species of big bluestem. This condition developed under total protection and no utilization of this grass. While this condition probably represents climax or sub-climax of the grass type, the type is so limited and surrounded as the Monument is by land subject to intense agricultural practices, there will always be a source of infestation for undesirable vegetation into the stand.

We note you suggest having the entire prairie mowed in June and the cuttings removed completely. While this would be more desirable as regards condition of the hay thus obtained, it would appear preferable to accomplish a somewhat later mowing, possibly during late July or early August after the grass stand is cured and thus obtain more effective fire hazard reduction which could be effective into the critical fall season. This is indicated as a maximum of flash fuels would be removed and the grass stand could increase in vigor accordingly. Should you feel it necessary to mow the stabilized eroded areas as outlined on page 6 of the Master Plan due to the invasion of weeds or other noxious vegetation, we believe a mowing operation in these sites which results in chopping or fine shredding the grass clippings would be desirable. Such a mowing operation could be accomplished using a "brush-hog" mower which is similar to the large circular blade mower used for lawns and formal areas. Brush-hogs are capable of clipping weeds, brush, grass, seedling trees, and even saplings up to two and three inches in diameter, depending on the species, while at the same time more or less pulverizing the material cut. The present Monument equipment on hand could probably operate a brush-hog. Undoubtedly one or two brush-hogs are available locally. The level portions of the grass stands outside of the stabilized eroded areas which would be brush-hogged could be harvested for hay and should produce some very desirable native hay.

Regarding your request for suggestions as to disposal of the hay, at this time it appears practical to contract for cutting and removal of the hay outside of the stabilized eroded areas through the issuance of a special use permit such as was used during 1955 when Mr. W. F. Thimm carried out such an operation. The mowing of the stabilized eroded areas would in all probability have to be accomplished as a part of maintenance activities or normal operation. An operation similar to that accomplished last summer when a small section was mowed to control spread of weeds is indicated.

Incidentally, the brush-hogging of the small area of smooth brome grass, rather than mowing, this spring season may prove more effective in converting this site entirely to native species.

Should you have any questions regarding the disposal procedure or the suggested methods of weed control and hazard reduction in the grass stand, please advise.

Fred F. Dickison

Fred F. Dickison
Forester

UNITED STATES GOVERNMENT
Memorandum

D54

TO : The Files DATE: September 28, 1

FROM : Historian

SUBJECT: Restoration of Native Prairie

A visitor talked to Seasonal Ranger Don Schnier yesterday about the weed problem we are having. Since the visitor, Lyle Stock of Murdock, Nebraska, grows native grasses commercially, we felt his comments worthwhile.

In discussing the 8 acres east of the bridge, Mr. Stock recommended the following procedure:

1. In the spring, burn the whole 8 acres. Do not plow. (weedy area)
2. Disk and harrow several times until the soil is mellow.
3. Seed the area - a little heavier than we have.
4. Shred the weeds several times.
5. Spray in mid or late summer, after all grass seeds have germinated. He recommends a chemical called Accrazene or Attrazine. This chemical will kill weeds, even blue grass and foxtails, but will only stunt the growth of native grasses.
6. For more advice or the purchase of native grass seed, contact Mr. Hummel of Fairbury.

Fahy C. Whitaker
Fahy C. Whitaker

1 Superintendent
Historian
2 Adm. Asst.
Clerk-Typist
3 Caretaker

File

Homestead National Monument
Beatrice, Nebraska 68310

D54

June 4, 1975

Dr. Roger Landers
Dept. Botany & Plant P.
Iowa State University
Ames, Iowa 50010

Dear Roger:

We appreciate your interest and concern about our prairie and are confident that your research project will result in an excellent management tool for our continuing prairie management efforts.

We are happy to forward a copy of the June 4, 1970, D54 memorandum, as requested. Our Maintenanceman, Gene Norman, who did the actual seeding, recalls that the time of year was fall (Labor Day) for the grass seeding. However, he states that a tall type of cane grass (probably Sudan) was planted in the spring of 1969 and after the growing season was mulched and tilled under prior to the fall seeding of prairie grasses.

seeded Nov. (weedy area)

We enjoyed your visit and guided tour through the prairie immensely. It was a learning experience as well as a pleasure. We look forward to your future visit during the growing season this year.

Sincerely yours,

Vincent J. Halvorson
Superintendent

Enc.

Memorandum

Y1819

TO : [illegible]

DATE: [illegible] August 26, 1983

Through : ~~Chief Ranger~~, Homestead NM

FROM : Park Technician, Resources Management, Homestead NM

SUBJECT: 1983 Prairie Burn: Post-burn Evaluation

Since the last complete prescribed prairie fire in 1970, some negative changes occurred on the area. Numerous woody thickets encroached, especially on the lowland to the south. Litter build-up suppressed growth of the native grasses and forbs. Some areas also showed encroachment of broadleaf and grassy non-native plant species.

The main objective of the prescribed fire was to provide better growing conditions for the prairie's native vegetation. Between April 20 to 26, 1983, all prairie areas of the Monument (including the Freeman School prairie) were burned. Particular areas of interest regarding the results of the burn were addressed. The results of these actions follow:

Fuel Loading

The thatch or litter build-up on the upland and lowland was determined by using a one yard square quadrant and sampling the total vegetation present within the square. The samples were dryed at 110°F. for at least 48 hours and their biomass determined. This was converted to tons per acre as a usable measurement. The results follow:

Upland - 1120 g./yd.^{2} = 11,954.8 lbs./acre = 5.98 tons/acre
Lowland - 1220 g./yd.^{2} = 13,019.6 lbs./acre = 6.51 tons/acre
School Prairie-1060 g./yd.^{2} = 11,277.2 lbs./acre = 5.64 tons/acre

These figures show a considerable amount of litter present, well above average grassland fuel loads of 2-3 tons/acre, and undoubtedly caused poor production of prairie plants. After burning, most areas showed a quite complete burn of the thatch, except for the weedy invaded area in the north 40 acre tract of the Monument.

New or Accelerator Species

Results of the burn show a great boost to the growth of native species, particularly the warm season grasses. As of August 26, 1983, most of these have gone to seed and reached their maximum height. (See table below)

Big Bluestem (*Andropogon gerardi*)	7-9 foot
Prairie Cordgrass (*Spartina pectinata*)	8-9 foot
Indian grass (*Sorghastrum nutans*)	5-6 foot
Switchgrass (*Panicum virgatum*)	5-6 foot

Visual estimates show that the bottomland vegetation is quite lush with great amounts of seed production occurring. The uplands are doing well, considering the hot drought period this summer. Little Bluestem (Andropogon scoparius) is evident but has not seeded-out yet. Overall, the growth of the grasses is considerably better than in recent years.

Some new wild flowers and grasses were also discovered on the upland that were not documented last year. Others proved to be more abundant since the burn. A list of new plants occurring this year follows:

White-eyed Grass (Sisyrinchium campestre)
Prairie Larkspur (Delphinium virescens)
Prairie Violet (Viola pedatifida)
Purple Prairie Coneflower (Black Samson) (Echinacea angustifolia)
Purple Prairie Clover (Petalostemon purpureum)
White Prairie Clover (Petalostemon candidum)
Tall White Wildindigo (Baptisia leucantha)
False Wildindigo (Baptisia leucophaea)
Dotted Gay Feather (Liatris punctata)
Downy Gentian (Gentiana puberulenta)
Porcupinegrass (Stipa spartea)

These are all noteworthy preferred native prairie species. It seemed that no other desirable native plants present last year (ie. Butterfly Weed, Canada Milk Vetch, Hawkweed, etc.) were harmed, but instead, were growing better in most cases.

Reduction in Woody Thickets

We hoped to stunt or kill many of the woody species in the prairie. (Original true prairie contained few woody-type plants due to the action of fire.) Wild Plum (Prunus americana), Rough-leaved Dogwood (Cornus drummondii), Smooth Sumac (Rhus glabra), and Choke Cherry (Prunus virginiana) are all common, particularly in the wet areas (washes) and semi-upland of the three south 40 acre tracts. Some Wild Plum thickets are at least 40-50 foot in diameter, but most are considerably smaller.

To determine the killing force of the fire, we established various stations on the prairie for placement of heat sensitive plates (see map 1). These plates were treated with Tempilaq; a temperature indicating liquid with a $\pm 1\%$ accuracy rating. At each station, we placed these plates at ground level, one foot above ground, and three foot above ground. The results at each station are found in the table on page 4.

Jo Wm

Station	Ground F° Temp.	1 Foot F° Temp.	3 Foot F° Temp.
1 (School)	400	200	200
2	1400	800	500
3	1400	600	500
4	800	400	200
5	400	200	200
6	800	500	400
7	800	200	200

In observing the thickets, it was noted that many of the small thickets, particularly between stations 4 and 5, showed signs of die-back. Many of these have no green vegetation present except for some suckering from the root stock at the base of the plants. The larger thickets were void of fine fuel underneath and so only the periphery of the thickets were adversely affected. Current observations show little damage by fire to these big clumps, however, very little fruiting, especially of the Wild Plum, actually took place this season.

One negative aspect of the fire was the affect it had on the Smooth Sumac and many of the Rough-leaved Dogwood. These species are fire-loving and propagate even more after a burn. This occurred after our burn as well. Even though the fire killed the above ground portions of many Sumac and Dogwood, they suckered back profusely from the root stock. The triangle of land in the northeast corner of the southeast 40 acre tract particularly contains much Sumac. This problem will need to be addressed promptly or else the prairie species (grasses and forbs) present will be totally lost in these areas.

Many small trees were also damaged in the fire. At least enough to be considered an eye-sore and were removed following the burn.

Timing of the Burn

The timeliness of the burn was good for controlling non-native species. Smooth Brome (Bromus inermis) and related cool season grasses were stunted immensely. Current observations show these to be approximately one-half of their normal height with very limited seed production in the burned areas.

The fire also was effective in stunting weed growth in the weedy invaded area (middle of north 40 acre tract) in most locations. We did have some problem getting the fire to burn through the area since last year's stand of Mare's Tail (Conyza canadensis) did not burn well with its heavy, pithy stocks. Areas that did burn completely showed fairly good stunting to the Foxtail (Setaria sp.), Nettles (Urtica sp.) and the Mare's Tail. The Mare's Tail never did germinate but the others mentioned were only slowed; resulting in some seed reduction. (This weedy area was cut, then burned again for more complete control, on August 3, 1983, after initially mowing with a sickle bar on July 13, 1983. (For more information on this action, see File Y1819, Fire #83-06C).

Burning also increased the abundance of some less desireable native plants. The lowland moist areas show very dense stands of Sunflower (Helianthus sp.) that were not so evident last season. Evidently, the mechanical action of the fire caused profuse germination of the seeds present. Common Milkweed (Asclepias syriaca) and Hemp Dogbane (Apocynum cannabinum) also increased in some areas, but are not as visually evident since they are fairly low growing compared to the large Sunflowers.

Wildlife Observations

Some new wildlife seems to have been attracted to the Monument. The day after the burn, an Upland Sandpiper (Bartramia longicauda) was observed on the prairie. This species has not been noted here in recent years. Bird censuses have shown many more Dickcissels (Spiza americana) also. A recent census shows offspring present which indicates good nesting success. Few were seen last summer. Some Meadowlarks (Sturnella sp.) were noted earlier following the fire, but no nests or young have been spotted recently. No Meadowlarks were even noted on the prairie last summer. Two other prairie bird species noted but not seen in recent years are the Grasshopper Sparrow (Ammodramus savannarum) and Field Sparrow (Spizella pusilla). Overall, the bird population here is good. Many nests have been found and documented this season. Offspring are quite evident on the prairie areas. Some egg mortality of ground nesting species (such as Ring-necked Pheasant, (Phasianus colchicus) was noted.

We did not conduct a mammal inventory this season. The burn results affecting the mammals is not fully known but some simple observations have been made. Franklin's Ground Squirrels (Citellus franklinii) are making new residence here. The Eastern Cottontail Rabbit (Sylvilagus floridanus) population has definately increased (this may or may not be a result of fire). The affect on the small mammal population (ie. mice, voles, shrews, etc.) cannot be determined, but some mortalities occurred due to the burn.

An insect inventory is currently being conducted and many specimens have been collected. The fire has had no apparent detrimental affects on the insect population.

The American Dog Tick (Dermacentor variabilis) has been a concern in past years since it is a known vector for Rocky Mountain Spotted Fever and other diseases. The species was very abundant here last year, particularly during the summer months. The burn had a dramatic affect on controlling their numbers this year on the prairie. The dry, hot weather, no doubt, has also helped to reduce their occurance.

Conclusion

Our evaluation of the burn indicated it was a success. All of our objectives were met. Other positive aspects not considered earlier were noted.

It is important that we continue to use fire as a prairie management tool. It was a definate controlling force governing the vigor of prairie and its related ecosystem before man began to suppress it. Many species of plants and animals have adapted to these conditions that fire creates.

Burning through woody growth on invaded prairie areas, two years in a row, is a recommended practice of prairie managers attempting to control it, (except for Sumac). This may be advisable here at Homestead, since we have limited the woody vegetation's food reserve and vigor with this season's fire.

Burning of the remaining prairie should be performed about every three to five years, early in the spring, similar to this year. It will leave the native forbs basically unharmed but should stunt the cool season non-native varieties.

It is important that one consider stress factors upon the native species as well. A series of drought years can put a great deal of stress on the grasses and forbs here.

Prescribed burns may need to be deferred until the desireable plant species have an opportunity to recover.

David L. Jenson

David L. Jenson

cc: Supt.
Interp.
Gary Willson
Ben Holmes

APPENDIX II

SOUTHWEST
FOREST & RANGE
Berkeley, Calif.

A Guide for Recording Esthetic and Biologic Changes With Photographs

ARTHUR W. MAGILL and R.H. TWISS

ABSTRACT: Photography has long been a useful tool for recording and analyzing environmental conditions. Permanent camera points can be established to help detect and analyze changes in the esthetics and ecology of wildland resources. This note describes the usefulness of permanent camera points and outlines procedures for establishing points and recording data.

Wildlands are becoming more "visible" everyday as highways, roads, trails, and recreation use proliferate. The immediate concern over the visual or scenic quality of the nation's environment has been highlighted most recently by the President's message on natural beauty.[1] And the growing importance of sightseeing and recreation travel is amply documented in the Outdoor Recreation Resources Review Commission's summary report.[2]

Scenery has long been considered important in roadside zones, and in recreation, scenic, and natural areas. But it is becoming increasingly vital to consider the visual composition of all wildland areas. Every land management action should be considered in terms of its contribution to, or detraction from, the broad regional landscape.

This note outlines a procedure to help record and analyse visual conditions and changes occuring over time. It proposes the setting up of permanent camera points and keeping of photographic records.

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[1]House Document 78, Feb. 8, 1965.

[2]ORRRC. Outdoor recreation for America. 246 pp., illus., Washington, D.C. 1962.

Value of Photographs

Photographs taken systematically can not only document obvious physical changes, but often can reveal deeper problems associated with soils and plant communities, and point up the need for concentrated ecological research.[3] They can help detect gradual but serious changes that might otherwise go unnoticed because of constant close association or because of a turn-over in personnel. For a continuing and meaningful record, photos should be taken at a minimum of 5-year intervals even if few changes are immediately obvious.

Certainly the use of photographs to record environmental conditions and changes is not a new concept. Aerial photographs have many applications to recreation problems.[4] For our purposes, however, ordinary photographs have many advantages, such as capturing the scene from the visitor's point of view. Several recreation studies[5] have been based on comparisons between old and recent pictures.

For day-to-day picture taking, the methods described here may not be suitable, and some photographers will probably want to continue personal or administrative practices. But for permanent camera points, the system described in this note has several advantages. For example, pictures are mounted in binders that can be easily carried in the field with photo-cards; they can be used to reestablish camera points when the pictures are retaken. Furthermore, pictures taken at various intervals are mounted together in the same binder where they can be easily compared.

Establishing Permanent Camera Points

Permanent camera points should be established at two types of locations: (a) sites normally subject to concentrated recreational impact, such as campgrounds, picnic areas, winter sports areas, water sports areas, recreation residence tracts, and resorts; and (b) key points along highways, trails, and rivers, within recreation areas, including wilderness type areas, where it is desirable to maintain esthetically pleasing landscapes.

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[3] Use of photos alone has definite limitations as a primary research tool. See: La Page, W.F. A photo record study of vegetational changes at Chapman Dam State Park. 4 pp., illus. 1965. (Unpublished office report on file at the Northeastern Forest Expt. Station, Warren, Pennsylvania.)

[4] Colwell, Robert N., and Marcus, Leslie F. Determining the specifications for special purpose photography. Photogrammetric Engin. 27(4): 620-626, illus. 1961.

[5] Examples include: Gibbons, R.P., and Heady, H.F. The influence of modern man on the vegetation of Yosemite Valley. Univ. of Calif. Division of Agr. Sciences. Manual 36, 44 pp., illus. 1964; Hartesveldt, R. J. The effects of human impact upon *Sequoia gigantea* and its environment in the Mariposa Grove, Yosemite National Park, Calif. 310 pp., illus. 1962. (Unpublished doctor's thesis on file at the University of Michigan, Ann Arbor.); Sharsmith, C. W. A report on the status, changes and ecology of back country meadows in Sequoia and Kings Canyon National Parks. 1959. (Unpub. report on file at National Park Serv. Regional Office, San Francisco, Calif.); Snyder, A. P. Wilderness area management. An administrative study of a portion of the High Sierra Wilderness Area. U.S. Forest Service, Region 5. 62 pp., illus. 1960

Permanent camera points should be located to take advantage of permanent landmarks such as stumps, boulders, or other large objects. which can be suitably marked and referenced for future identification. Where it is not possible to set-up over such objects, then a redwood stake may be driven flush to the soil surface and carefully referenced. In recreation areas, all markers must be as inconspicuous as possible to minimize their loss by vandalism or accidental destruction by visitors.

Referencing may not be necessary if permanent camera points are established over permanent and easily identifiable objects, otherwise they should be referenced by three permanent objects, such as trees or boulders. Bearing trees should be identified by species, diameter, and a bark scribe, or some other mark placed as high as possible on the side facing the permanent camera point. Bearing objects consisting of rock or concrete should have a small identification mark etched on by a cold chisel. (Remember safety goggles whenever rock or concrete are to be chiselled.) Rocks should be described according to length, width, height; such objects as barrier posts or buildings may be identified by brief verbal descriptions. Bearings (in whole degrees) and distances (in feet or inches depending on the scale involved) should be determined from the bearing points to the permanent camera points.

Recording Data

All information describing pictures, identifying the photographer, and specifying locations should be recorded before the photographer leaves the site. Cards in the shape and size suitable for electronic data processing can be used to record this information (fig. 1). Not all the space titles on the card may have obvious meanings, and therefore a few definitions follow:

File number: the photographer's personal file number.

Official Forest Service number: an agency's official file number.

Index data: various combinations of descriptor terms used to identify and catalog photographs according to subject matter.

Distance: the distance from the camera to the subject in feet, or the infinity symbol for large distances.

Support: method for supporting the camera--"H" by hand or "T" by tripod.

Rating: the exposure-index of the film being used.

PHOTO-CARD

FILE No.	INDEX DATA
0091	DAMAGE
OFFICIAL F.S. No.	soil
	human
PCP No. 75	

TAKEN BY A.W. Magill

DATE 8/10/61 HOUR 2 p.m.

SUBJECT

Litter removed and soil disturbed in a family unit

LOCATION

Wounded Buck Campground Cleveland National Forest

CAMERA Graphic

LENS 105 mm FILTER A - 25

DISTANCE ∞ EXP. TIME 1/125

DIRECTION SW SUPPORT T

FILM Tri - X

SIZE 2 1/4 x 3 1/4 RATING 400

LIGHT CONDITIONS

NATURAL ✓ ARTIFICIAL

EXP. METER USED ✓ NOT USED

MAKE GE

FIELD AND OFFICE NOTES

DEVELOPED BY Ok Camera Co.

DATE 8/25/61

USE REVERSE SIDE FOR ADDITIONAL NOTES

Redwood stake set flush to the soil surface.

Magnetic bearings from:

BT

JP - 31"

14 1/2 feet - N 5°E

Rock

30" x 45" x 36"

21 feet - N 46°E

Barrier post

SE end of barrier

21 inches - S 9°E

Figure 1.--Front and back of card for recording photo data.

The permanent camera points should be listed numerically, and the file number of each picture taken at a particular camera point should be recorded (fig. 2). Such a list is necessary whenever photo-cards are used to record pictures taken both at permanent camera points and at other locations.

The descriptor terms, recorded in the "index data" space, are composed of primary descriptors that define broad subject fields. Secondary and tertiary descriptors are used to elaborate and clarify the meaning of primary terms. An alphabetical listing of various combinations or descriptors that are now being used is given in table 1. Naturally other terms may need to be devised.

Information on the camera and film is needed to avoid possible misinterpretations due to changing photographers or equipment. It is usually enough to record bearings and distances from the witness points. But whenever a difficult problem of relocation is expected it may prove valuable to include a small sketch map and description on the back of the card.

The photographer's name and identifying number should be marked on the margin of the negatives with india ink and on the back of the prints. Negatives can be placed in individual glassine envelopes bearing the photograph number and filed in numerical order. Prints

Figure 2.--Permanent camera points should be listed numerically and the record should also include the file number of each photo taken.

PERMANENT CAMERA POINT RECORD

Forest Recreation Research Project

Year	PCP	Primary Descriptor	Photograph No.	Photograph No.	Photograph No.	Forest Code	Plot Nos.--site descriptions
1961	10	Ecology	0177			01	Sage Flat Campground
	11	"	0178			01	" " "
1961	12	Research	0197			13	D-14, High Cpgd., Unit 6
1962	13	Arboriculture	0285			07	Rocky Bar Cpgd.
	14	"	0286			07	" " "
	15	Hazard	0301			15	Pines Picnic Area

Table 1.--*Subject matter descriptors for use in recording index data on photo-cards*

ARBORICULTURE Cultivation Fertilization Irrigation Planting Pruning AREAS Natural Picnic Recreation DAMAGE Objects Damaged: Esthetics Facilities Roots Shrubs Soils Trees Causative Agent: Entomology Erosion Fire Human Pathology Wildlife Wind	ECOLOGY Campgrounds Shrubs Soils Trees Vegetation ESTHETICS Bays (saltwater) Canyons Chaparral Deserts Forests Hills Lakes Meadows Mountains PARKS National Regional State PLANTING Campgrounds Landscapes Picnic Areas Roadsides Shrubs Trees Vegetation	RECREATION REGENERATION Shrubs Trees Vegetation SPORTS Camping Fishing Hunting Picnicking Winter Sports STABILIZATION Soils Vegetation WILDERNESS Primitive Wild

can be mounted on black paper, placed in plastic document protectors, and filed in three-ring photo-binders. To retrieve a negative from the numerical file, refer to (a) the number on the back of the photograph and mounting sheet in the photo-binder; (b) the photo-card; or (c) the permanent camera points numerical listing. Photo-binders and their contents can be organized by (a) subject matter, such as campgrounds, ecology, winter sports; (b) administrative units, such as forests, ranges, or watersheds; or (c) site locations, such as resorts, campgrounds, picnic areas, or vista points. (Site locations are more likely to be a subdivision within a photo-binder.)

Rephotographing Scenes

Repeat photographs should be taken by aligning the scene viewed through the camera's ground glass or view finder according to the original photo's framing. This procedure is made easier if the first photographer had included some foreground and selected easily recognized objects, such as large trees, for the margin of the picture.

The value of taking pictures to detect changes in soils and vegetation on high impact recreation sites is evident in comparing two photos taken 10 years apart (figs. 3, 4). Even though permanent camera points were not installed before 1964, we still were able to obtain valuable information by photographing the scene from about the original camera point. Since the original photo was taken in 1954, four trees have been removed, and a fifth is marked for cutting. Some understory

Figure 3.-- In 1954, this campground contained few shrubs, and young trees were not evident. The two center trees hid a third tree which was farther back but visible in the crowns.

Figure 4.--The same campground, in 1964, has lost the three trees mentioned in figure 1, and close inspection reveals a fourth lost in the background. A 'cut' mark appears on the forked tree to the left. Understory seems unchanged.

vegetation was lost but on the whole, the understory and soil surface appear relatively unchanged. The absence of tree and shrub regeneration is important where openings have developed in the forest (center of figure 4).

The two pictures depict some common photographic problems. First, both photos were taken at about the same time of year, which is desirable, but the shadows indicate that they were taken at different times of the day. As a result, some objects visible in figure 3 are hidden in figure 4. Second, different cameras were used. Figure 3 was taken with unspecified equipment, and figure 4--which covers slightly more area--had to be taken with a wide angle lens to obtain the required view. Finally, most of the foreground in the two photos appears to be properly aligned, barring differences in equipment, but some of the smaller background trees and the telephone poles seem to be mislocated. Although being slightly out of position was not too critical here, in other situations important detail could be lost.

The Authors.

are studying problems in the use of forest recreation areas, with headquarters in Berkeley. ARTHUR W. MAGILL native of Seattle, Washington, is a 1957 forestry graduate of the University of Washington, and earned a master's degree in forestry at the University of California in 1963. He joined the Forest Service in 1957. ROBERT H. TWISS, JR., is responsible for forest recreation studies at the Berkeley station. Native of Chicago, he holds three degrees in conservation: bachelor's from San Jose State College (1955), and master's (1960) and doctor's (1962) from the University of Michigan. He joined the Station staff in 1962.

RICHARD K. SUTTON
Landscape Architect
Registered in the State of Nebraska #131
1708 N. 32nd, Lincoln, Nebraska 68503
(402) 466-0557

Visual Analysis

HOMESTEAD NATIONAL MONUMENT

GAGE COUNTY, NEBRASKA

Management Unit____
•Photo Plot ____

1. Vegetation:

	Higher Quality	Lower Quality
a) Vividness	wide variety of colors, form and textures	monotonous and unchanging
b) Unity	vegetation patterns re-enforce existing spaces, uses and topography	vegetatoion pattern, random, arbitrary and unnatural
c) Intactness	clearings, scars and linear edges treated to reduce man's intrusion	scars, clearing edges and weeds very evident
	erosion not evident	erosion evident

2. Features:

	Higher Quality	Lower Quality
a) Vividness	viewpoints panoramic and memorable	views arbitrary, singular or non-existent
	long views	short views
b) Unity	trails and viewpoints and man-made features enhance visitor's access and make landscape more legible	trails random, ill-placed and inconvenient in interpretation of site
	strong natural spatial enclosure and edge definition	edges and spaces unnatural, random and poorly defined
c) Intactness	no man-made features on or offsite that interfer with the site's naturalness	man-made features intrude and compete with natural landscape

11 '9 1983

VISUAL QUALITY RATINGS

Management Unit Edge [illegible]
Photo Plot 1

		10 Higher Quality	1 Lower Quality
1. Vegetation: a) Vividness	3	wide variety of colors, form and textures	monotonous and uncha
b) Unity	4	vegetation patterns re-enforce existing spaces, uses and topography	vegetation pattern, random, arbitrary an unnatural
c) Intactness	4	clearings, scars and linear edges treated to reduce man's intrusion	scars, clearing edge and weeds very evide
	9	erosion not evident	erosion evident
2. Features: a) Vividness	3	viewpoints panoramic and memorable	views arbitrary, or non-existent
	4	long views	short views
b) Unity	5	trails and viewpoints and man-made features enhance visitor's access and make landscape more legible	trails random, ill-pl and inconvenient in interpretation of sit
	3	strong natural spatial enclosure and edge definition	edges and spaces unna ural, random and poor defined
c) Intactness	2	no man-made features on or offsite that interfere with the site's naturalness	man-made features int and compete with natu landscape

1983

VISUAL QUALITY RATINGS

Management Unit [illegible]
Photo Plot 2

		10 Higher Quality	1 Lower Quality
1. Vegetation: a) Vividness	3	wide variety of colors, form and textures	monotonous and uncha
b) Unity	3	vegetation patterns re-enforce existing spaces, uses and topography	vegetatoion pattern, random, arbitrary an unnatural
c) Intactness	3	clearings, scars and linear edges treated to reduce man's intrusion	scars, clearing edge and weeds very evide
	9	erosion not evident	erosion evident
2. Features: a) Vividness	2	viewpoints panoramic and memorable	views arbitrary, sing or non-existent
	2	long views	short views
b) Unity	5	trails and viewpoints and man-made features enhance visitor's access and make landscape more legible	trails random, ill-pl and inconvenient in interpretation of sit
	4	strong natural spatial enclosure and edge definition	edges and spaces unna ural, random and poor defined
c) Intactness	2	no man-made features on or offsite that interfere with the site's naturalness	man-made features int and compete with natu landscape

(Housing [illegible])

. CUTTON

11 9. 1988

VISUAL QUALITY RATINGS

Management Unit [illegible]
Photo Plot 3

1. Vegetation; | Higher Quality | Lower Quality

a) Vividness

5 — wide variety of colors, form and textures | monotonous and unch

b) Unity

3 — vegetation patterns re-enforce existing spaces, uses and topography | vegetation pattern random, arbitrary ar unnatural

c) Intactness

2 — clearings, scars and linear edges treated to reduce man's intrusion | scars, clearing edge and weeds very evide

erosion not evident | erosion evident

4

2. Features:

a) Vividness

4 — viewpoints panoramic and memorable | views arbitrary, or non-existent

6 — long views | short views

b) Unity

5 — trails and viewpoints and man-made features enhance visitor's access and make landscape more legible | trails random, ill-p and inconvenient in interpretation of si

3 — strong natural spatial enclosure and edge definition | edges and spaces unna ural, random and poor defined

c) Intactness

2 — no man-made features on or offsite that interfere with the site's naturalness | man-made features int and compete with nat landscape

VISUAL QUALITY RATINGS

Management Unit ___
Photo Plot 7

1. Vegetation:

		Higher Quality	Lower Quality
a) Vividness	5	wide variety of colors, form and textures	monotonous and unchan
b) Unity	5	vegetation patterns re-enforce existing spaces, uses and topography	vegetatoion pattern, random, arbitrary and unnatural
c) Intactness	5	clearings, scars and linear edges treated to reduce man's intrusion	scars, clearing edges and weeds very eviden
	9	erosion not evident	erosion evident

2. Features:

		Higher Quality	Lower Quality
a) Vividness	6	viewpoints panoramic and memorable	views arbitrary, sing or non-existent
	6	long views	short views
b) Unity	6	trails and viewpoints and man-made features enhance visitor's access and make landscape more legible	trails random, ill-pl and inconvenient in interpretation of sit
	5	strong natural spatial enclosure and edge definition	edges and spaces unna ural, random and poor defined
c) Intactness	7	no man-made features on or offsite that interfere with the site's naturalness	man-made features int and compete with natu landscape

11 · 9 198

VISUAL QUALITY RATINGS

Management Unit 1
Photo Plot 5

	Rating	Higher Quality	Lower Quality
1. Vegetation:			
a) Vividness	5	wide variety of colors, form and textures	monotonous and unch
b) Unity	5	vegetation patterns re-enforce existing spaces, uses and topography	vegetatoion pattern random, arbitrary a unnatural
c) Intactness	4	clearings, scars and linear edges treated to reduce man's intrusion	scars, clearing edge and weeds very evide
	8	erosion not evident	erosion evident
2. Features:			
a) Vividness	5	viewpoints panoramic and memorable	views arbitrary, or non-existent
		long views	short views
b) Unity	4	trails and viewpoints and man-made features enhance visitor's access and make landscape more legible	trails random, ill-p and inconvenient in interpretation of si
	3	strong natural spatial enclosure and edge definition	edges and spaces unn ural, random and poo defined
c) Intactness	2	no man-made features on or offsite that interfere with the site's naturalness	man-made features in and compete with nat landscape

VISUAL QUALITY RATINGS

Management Unit Fu...
Photo Plot 6

Criterion	Rating	Higher Quality	Lower Quality
1. Vegetation:	40		
a) Vividness	4	wide variety of colors, form and textures	monotonous and unchan
b) Unity	4	vegetation patterns re-enforce existing spaces, uses and topography	vegetation pattern, random, arbitrary and unnatural
c) Intactness	3	clearings, scars and linear edges treated to reduce man's intrusion	scars, clearing edges and weeds very eviden
	3	erosion not evident	erosion evident
2. Features:			
a) Vividness	2	viewpoints panoramic and memorable (Short)	views arbitrary, singu or non-existent
	1	long views (Short)	short views
b) Unity	3	trails and viewpoints and man-made features enhance visitor's access and make landscape more legible	trails random, ill-pla and inconvenient in interpretation of site
		strong natural spatial enclosure and edge definition	edges and spaces unnatural, random and poorl defined
c) Intactness	2	no man-made features on or offsite that interfere with the site's naturalness	man-made features intr and compete with natur landscape

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PACIFIC SOUTHWEST Forest and Range Experiment Station

SERVICE
ARTMENT OF AGRICULTURE
245, BERKELEY, CALIFORNIA 94701

LANDSCAPE CONTROL POINTS:
a procedure for predicting and monitoring visual impacts

R. Burton Litton, Jr.

USDA FOREST SERVICE RESEARCH PAPER

CONTENTS

THE AUTHOR

R. BURTON LITTON, JR., holds appointments with both the Forest Service and the University of California. He is a landscape architect with the Station's forest recreation research unit, and professor and chairman of the University's Department of Landscape Architecture, at Berkeley. He earned a bachelor of science degree in landscape architecture (1941) at the University of California, Berkeley, and a master of landscape architecture degree (1948) at Iowa State University. He joined the University faculty in 1948 and the Forest Service in 1969.

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Generalizations about esthetics and protection of "natural beauty" are of small help to the land manager. He needs some way to anticipate the visual impacts of management alternatives, some way of assessing the sensitivity of the landscape as it may be affected by possible alterations. In planning for multiple use of the land, he needs a procedure that can accommodate the different perceptions of changes in the landscape that are inherent in various disciplines.

An approach that may be helpful is to use a network of Landscape Control Points (LCP)—backed up by plots of visible areas shown on topographic maps, panoramic photographs, sketches, and overlays. The network has two purposes: (a) to emphasize the landscape as a scenic resource; and (b) to contribute to more effective control of change through an orderly process of direct field review. This approach can help the land manager visualize alternatives and enable him to choose those most fitting in a given situation.

An individual LCP is a fixed station from which a broad, intermediately distant view of the landscape may be seen. In an earlier report, I described three locations of the observer as he looks upon a visual objective: "observer inferior"—if he is below it, "observer normal"—if he is at the same level, and "observer superior"—if he is above it (Litton 1968, p. 5-10).

In *figure 1*, the observer is in a "normal" position and the distance is that of the "middle ground," defined as a distance range of one-half to 5 miles or more to the ridge (Litton 1968, p. 3-4). Other observer positions ("inferior or superior") would do as well just so long as there is an unobstructed view of the landscape's main structure—its form and space. Variables in the objectives' size and shape, color brilliance, and atmospheric and light conditions make it difficult and misleading to give set distance limitations. In another example *(fig. 2)*, a square selective cut, ½ mile by ½ mile, is readily visible—yet subtle—at a distance of 9 miles. Arbitrary rules for fixing point locations or defining view characteristics cannot substitute judgment to be exercised in specific regions and places.

This paper outlines a five-step procedure for locating and using Landscape Control Points to study landscape and the visual impacts of alterations, describes the criteria for locating such points, explains three different ways of plotting the visible landscape, and offers a case study of how the procedure was applied on the Teton National Forest in Wyoming.

FIVE-STEP PROCEDURE

Establish Landscape Control Points

• *Step 1:* Establish a network of LCPs to give a reasonably continuous view of an extended area.

As an example, a set of viewing stations along the highways and roads of a National Forest provides a visual sampling of that Forest. The landscape seen would be but a small part of the Forest's total area, but it would represent a significant image most readily available to the public. Ideally, the LCPs should overlap with one another so the comprehensiveness of a continuous visual corridor is developed. It is also desirable for LCPs to give different views of the same landscape segment—especially for segments judged to be scenically significant or more vulnerable to impacts of use than others.

A network could also be built upon other means of coverage, such as using points on a grid system or selecting good viewing points from topographic maps and stereoscopic air photos.

Plot Visible Landscape

• *Step 2:* Plot on a topographic map the limits of the visible area seen from each LCP.

This plotting can be done in the field by translating observed visual boundaries into lines on a map. The areas seen from each viewing station are joined together so that a generally continuous plot of visibility is obtained. At the same time, what can be seen from each LCP can be identified.

Several more refined methods of determining the limits of visual areas and their map location are also possible: (a) the use of hand-drawn sections devel-

Figure 1—View of an intermediately distance landscape from a Landscape Control Point. The observer is in a "normal position," seeing the object at the same level. (Pat O'Hara Mountain, Park County, Wyoming)

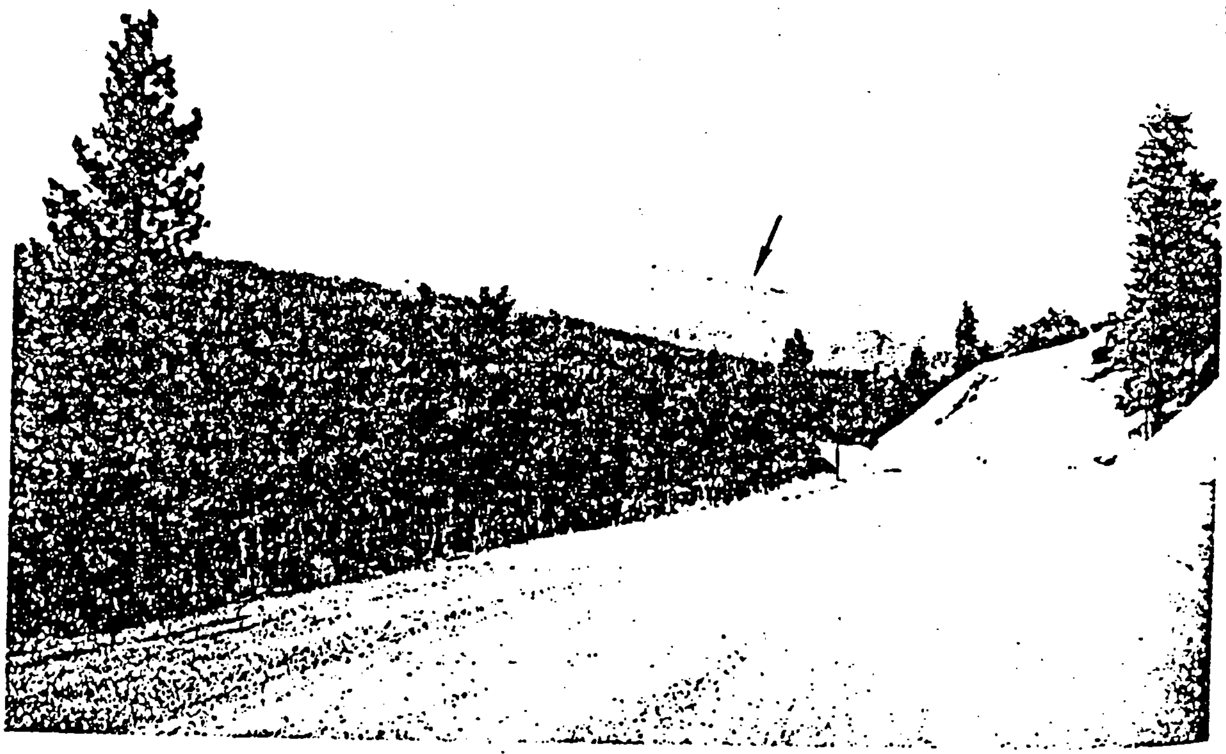


Figure 2—Square selective cut, one-half mile square, on private land in the Hayfork Ranger District, Shasta-Trinity National Forests, California. The observer can see a distance of 9 miles.

oped as rays from a Landscape Control Point; and (b) application of the VIEWIT computer mapping technique (Amidon and Elsner 1968). Both of these techniques have certain advantages of convenience and accuracy compared to field plotting. Working in the field does, however, provide the additional opportunity for making qualitative observations about the particular landscapes involved. A combination and balance between field and office methods of plotting should be the goal.

Photograph Panoramic View

• *Step 3:* Photograph a panoramic view from each of the LCPs, selecting a suitable time of day and season for each situation.

Replication of the same view at different seasons of the year will be needed to represent changing emphasis in the way the landscape looks. The photographic view serves as a general record taken from a specific station at a specific time. It will also be useful as a base for sketch overlays which result from studies of various project proposals. As a guide to recording the photo data, see the publication by Magill and Twiss (1965).

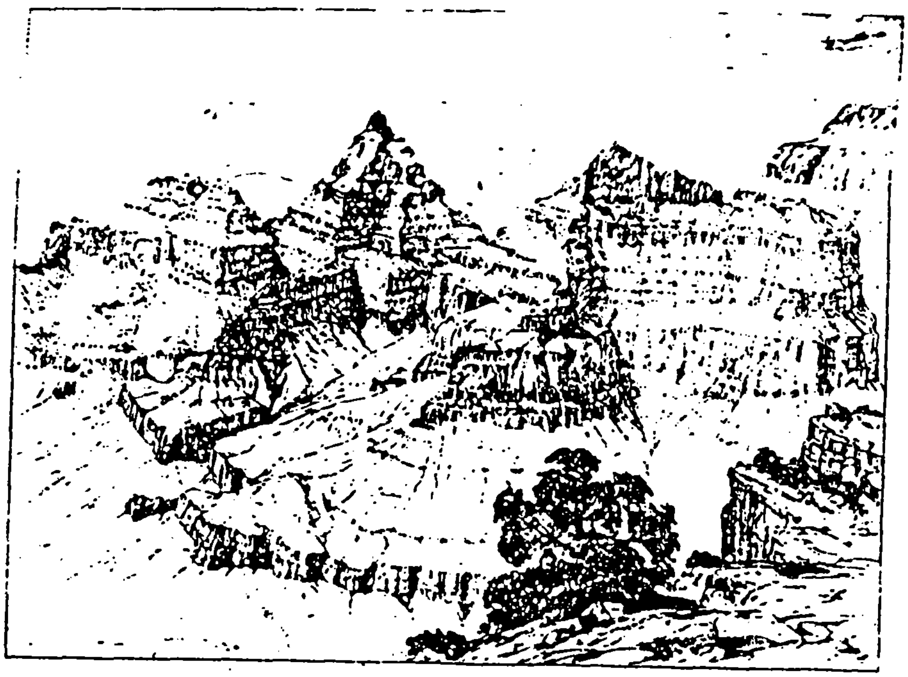
Equipment such as 2¼- by 2¼-inch twin lens reflex camera mounted on a pan head with level bubble will produce both good normal photographs (about 45° angle of view) from single negatives as well as broad view panoramic mosaics from a set of negatives. More specialized cameras, such as the Widelux (Panon Camera Shoko Co., Ltd.) or Panoram 120 (Burke & James, Inc.) produce wide angle views (140° and 120°, respectively) from a single negative.[1]

Prepare Perspective Sketches

• *Step 4:* For more specific parts of a broad photographic panorama, prepare perspective field sketches as a base for more precise or finer grained studies of possible changes and alternatives.

A sketch might well direct attention to the particularly sensitive landscape related to a feature, such as a dominant mountain peak or lake. Drawings of this kind do require a certain expertise, but they offer a means of concentrating upon major compositional aspects of the landscape while at the same time simplifying certain complexities associated with detail. In the realm of scientific art--not to be compared to "field sketches"--the remarkable Grand Canyon drawings of William Henry Holmes show how well the landscape may be interpreted through drawings (Dutton 1882) *(fig. 3)*.

[1]Trade names and commercial enterprises or products are mentioned solely for information. No endorsement by the U.S. Department of Agriculture is implied.



...lliam Henry Holmes' draw... Grand Canyon in Arizona, ...nu's Temple," shows how ...ape can be interpreted ...medium.

Project Impact of Change

• *Step 5:* As elements of a management plan or a Forest Service multiple-use plan are studied and proposed, use the Landscape Control Points and the graphic information derived from them to project the possible impacts of planned proposals.

While ideas for the physical change are still tentative, their consideration and discussion of implications might well take place on the ground at the pertinent LCPs. As plans change from ideas to specific alternatives of physical design, projected graphic versions may be prepared as overlays to the photographic record (Step 3) or overlays to the sk record (Step 4). Then prepared visual displays ma considered on the ground, at the pertinent LCPs.

The results of carrying through to Step 5 sh provide greater recognition that various resource agement decisions carry seeds of different v changes in the landscape. Not all professional d plines are used to thinking in terms of visual products. And the integration–in some degree of various inputs of different disciplines could be a through this use of visual devices related to the l scape.

LOCATING LANDSCAPE CONTROL POINTS

Criteria for LCPs affecting their location and use involve relationships to: (a) roads and trails, air routes; (b) areas of congregation and concentrated use; (c) overviews covering landscapes of special value; (d) places and conditions offering best viewing opportunities; and (e) overlapping fields of view and different views of the same landscape segment.

Roads and Trails

Roads are more than a route between points; they are a viewing platform giving a visiting observer major impressions of a National Forest or other wildlands. The moving viewer can receive a complex set of images about the landscape that cannot be duplicated by the view from a single static point. Yet an individual LCP can represent, in some generality, a summary aspect from a particular section of road *(fig. 4)*.

The type of road offers a clue as to relative im tance of particular viewing points. A Federal h way, for example, is more critical than a local Fo system road because of larger traffic volume. overviews from Federal or State highways withi tional Forests show no immunity from impacts o that lie heavily on the land *(fig. 18)*. So also local roads. All roads have importance, howeve providing a comprehensive sense of a region an demonstrating the visual aspects of resource man ment–whether compatible with the landscape or

The length of time a particular landscape ca seen from one or more segments of road (Atki 1965) and the number of times that an objective may be sighted (Elsner 1971) should both figu the selection of LCPs *(figs. 7,8)*.

Trails, because of pedestrian rate of travel opportunity for concentration upon nearviews o

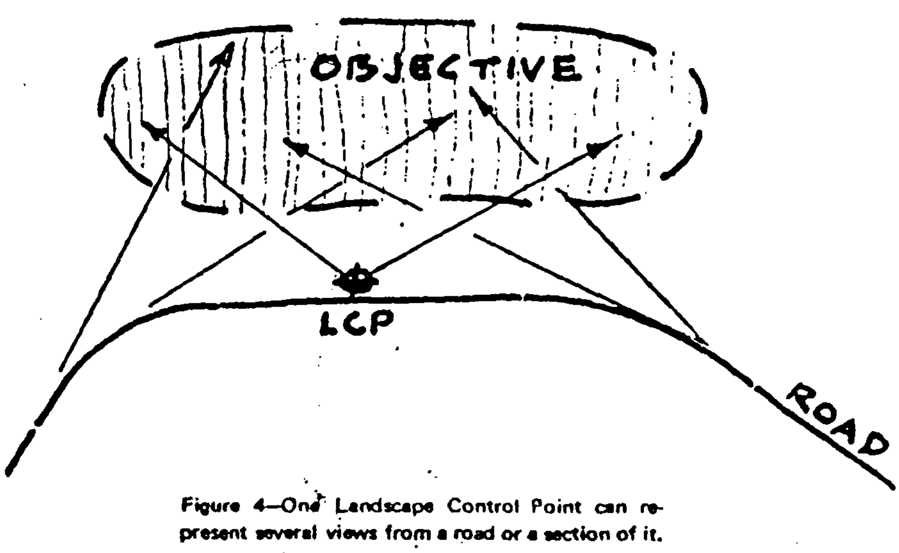


Figure 4—One Landscape Control Point can represent several views from a road or a section of it.

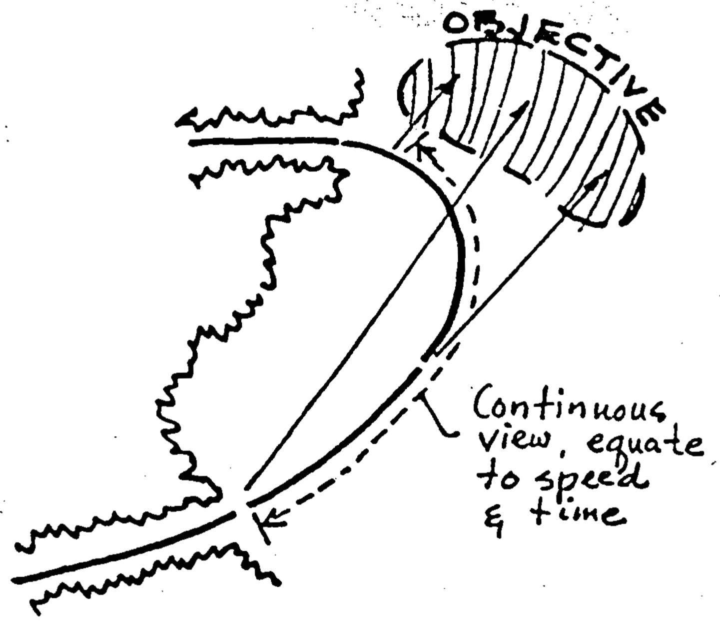


Figure 7—Continuous road viewing of one objective area.

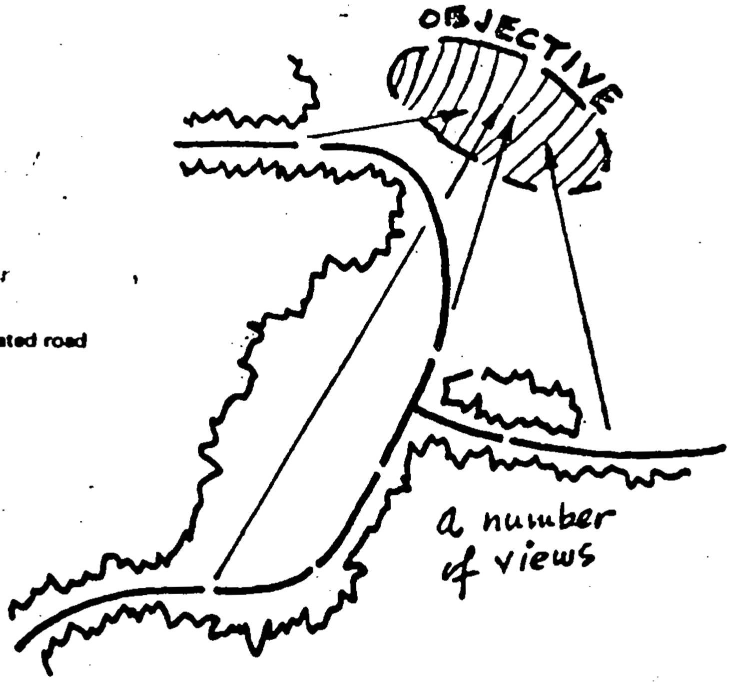


Figure 8—Intermittent and repeated road viewing of one objective area.

tail, are also important as the sites for viewing stations. A number of significant situations can be identified. Trailheads, where car travel stops and travel by slower means begins, represent a pedestrian concentration that may coincide with an important outview. Trails within Wilderness Areas--especially near forest boundaries--often include views into areas where timber cutting or road building are allowable. From such wild area points it must be assumed that sightseers will be especially sensitive to signs of manmade change that may be incompatible with the landscape (Lucas 1964). Thus it appears that trail LCPs from wilderness into the thresholds of wilderness serve a special purpose. Then, too, with trails representing slow travel and ease of stopping, vista points might well be used for longer periods of time and perhaps more critically than view points related to roads. LCPs associated with trails represent another link in the build-up of an over-all regional understanding.

The scope of this study has been limited to ground viewing. Visibility from air routes should also be taken into account and would add another measure of criticality. Techniques for visual monitoring by air have not been included here.

Areas of Concentrated Use

Congregation areas and points of concentrated or extended use indicate likely locations for LCPs. Scenic viewpoints or rest stops along roads are exam-

Figure 5—Panoramic landscape, a compositional type, as seen along a heavily traveled highway, on the Grand Mesa National Forest, Colorado.

Figure 6—Feature landscape, a composition type, as seen along a heavily used highway, near Challis, Idaho.

ples of short term viewer congregations a number of these have been used in the case study. Recreational facilities, such as ski areas (base areas and lifts in particular) or swimming beaches, represent concentrations of users who will have extended stays and numerous opportunities to view their surroundings. Campgrounds, where recreationists may "live" for a few days or a few weeks, should be represented by LCP locations if significant outviews are obtainable. Areas which are privately held, where people live or where urbanization exists, should be recognized as sensitive to the visual impacts which may come within view (USDA Forest Service 1970); these need to be included as critical locations for LCPs. Urbanization which expands into new places also can enlarge the total area that can be seen.

Landscapes of Special Value

Landscapes that can be recognized for their special merits must be accounted for in locating LCPs. Scenic outlook points along a road, for example, tend to use "observer superior" or "observer normal" positions which typically offer a comprehensive overview of some one of four types of landscape compositions (Litton 1968, p. 23-35). These compositions are identified as panoramic, feature, enclosed, or focal landscapes *(figs. 5,6,9,10)*. Each one may be looked upon as having particular kinds or zones of sensitivity where visual impacts of manipulation will be conspicuous. In these circumstances, the LCP enables the observer to have directed surveillance where disruptions or distractions would be most damaging: (a)

Figure 9—Enclosed landscape is a compositional type that is particularly sensitive to the visual impact of manipulation. (Tomales Bay State Park, California)

Figure 10—Focal landscape is another compositional type in which the visual impact of manipulation would be conspicuous. (Machias River, Washington County, Maine)

near the closeby elements of a panoramic landscape; (b) toward a feature itself or areas (i.e., vegetation patterns) near or closely linked with the dominant feature of a feature landscape; (c) toward the expanse of floor and walls (their integrity) of an enclosed landscape; and (d) at the focal zone (convergence area) of a focal landscape.

LCPs can and should be located to account for such visual nodes as these specific landscape compositions. The higher the observer position may be, the more complete (and useful) the landscape view will be. These views need not bear any relationship to designated observation spots along a road or trail.

Conditions Affecting Viewing

Seasonal changes and the variations of sunlight angles during the course of a day will enter into how effective a particular LCP may be. Winter aspects may include the maximum color value (brightness) contrasts between reflective snow patterns and dark co fer cover. Or the presence of conifer patterns wit deciduous hardwoods will be revealed in winter relationship apt to be obscure in summer. Spring a fall can present some other insights into vegetati pattern because of heightened contrasts in folia color. The mosaic of various surfaces visible in co bination needs to be considered for variations of se sonal change or annual stability: mineralized barren surfaces, grassland and forbs, brushland chaparral, conifer forest, hardwoods, and wat bodies.

For a comprehensive sense of how contrasts in t landscape change through the year, photograph documentation should record that range. It is a k point that the visual image which is the most vivid the one containing maximum seasonal contrasts should be the most graphic record of the landscap

The orientation of terrain and relationship to su angle will contribute to clarity or obscurity of visua images from a given LCP, affecting both direct observation and photography. The north-facing slope tends to be obscured during mid-day by the shadows of backlighting—it will be better revealed as it may be directly lit during early morning or late afternoon. South-facing terrain with front and side lighting can be expected to show up clearly during the mid-day hours—and with more modeling early and late in the day. Westerly faces can best be viewed in the afternoon hours, while morning will be a better time for east facing surfaces.

Overlapping Fields of View

Certain segments of the landscape can typically be seen from a number of different observer positions and a variety of orientations. LCPs as tools for visual management need to reflect these differences. The characteristics of a frontal view can be so dissimilar from a sharply foreshortened one that the two may seem to have little in common. One view (one LCP) may also be judged to hold priority over another. Judgment of priority could be based on factors, such as seeing a greater expanse, having more relationships among parts revealed, or an advantageous orientation. This judgment carries over into the nature of how proposed manipulations will be seen—what disappears in one aspect can be conspicuous—perhaps degrading—from another viewing station. Making use of several LCPs should be expected to lead to possible relocation of proposed manipulations or to alteration of their form or scale.

PLOTTING THE VISIBLE LANDSCAPE

Plotting the plan coverage of areas visible from a Landscape Control Point may be done three different ways:

1. By direct field observation and reference to a topographic map.
2. By drawing a series of sections radiating from the LCP, transferring points from section to topographic map, and connnecting points into visual limit lines on the map to form a "sectional" plot.
3. By employing a computerized technique, such as VIEWIT, which computes the area visible from one LCP (or many) and produces an overlay map (Elsner 1971).

Each of these methods offers certain advantages or disadvantages, such as requiring more time or less, greater accuracy or less. As an example, compare results from the three procedures, and their differences based on a common LCP *(fig. 11)*.

Direct Field Plotting

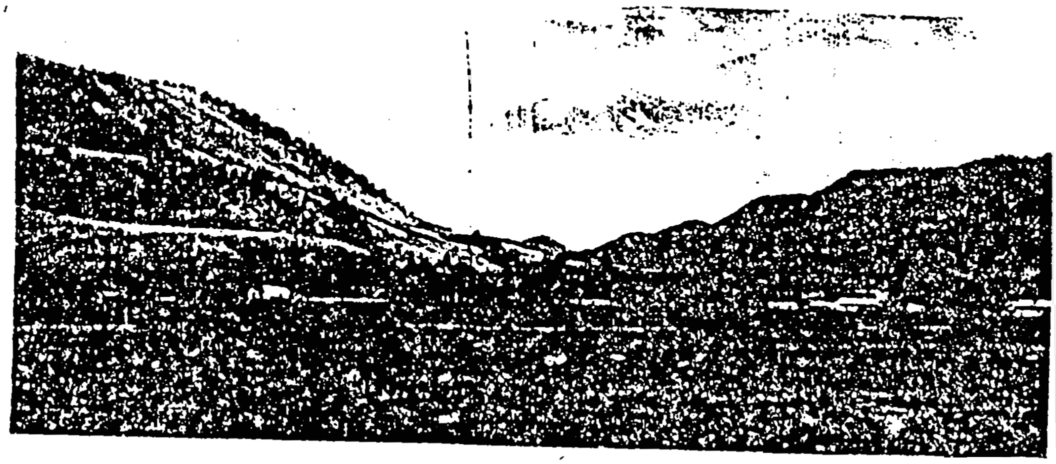
By taking a topographic map into the field and going to a selected LCP, the observer may transfer the visual limits of his observation to the map. This procedure will be familiar to anyone who has used a topographic map for location and orientation. It merely goes a step further in which visual boundaries are estimated relative to land forms and other elements, and those boundaries are set down as lines on the map.

The U.S. Geological Survey 7½-minute maps (1:24,000 or 1 inch = 2,000 ft.) are most desirable as base maps. Portrayal of land forms and features is normally clear enough and at sufficiently large scale so that locating visual limits can be done with relative ease and accuracy. These maps reduced 50 percent to a scale of 1:48,000 (1 inch = 4,000 ft.) can also be used and offer the convenience of smaller size. However, 15-minute topographic maps (1:62,500 or 1 inch = approx. 1 mile) are considerably more difficult to use because of possible errors in land form identification and problems of making the small scale plot. Therefore, their utility should be considered marginal.

A number of factors will affect the results of plotting in the field. Selection should be made of those times of day which will give the advantages of positive sun angle.

For any given LCP—which establishes a general orientation of view—sidelighting should be most advantageous. The flatness of front lighting makes it somewhat less desirable because land forms tend to merge with one another. Back lighting should be avoided, because of the obscurity it casts upon specific parts of the landscape. Weather or atmospheric conditions will also be recognized for the effects they have on visibility and can affect the quality of field work to be expected. The seasonal aspects of regional weather should enter into selection of better times for this particular kind of exercise.

Apart from direct plotting, it may also be the purpose of field work to compare a VIEWIT overlay or "sectional" plot to the actual landscape involved. This would be followed by photography (Step 3) and sketches (Step 4).



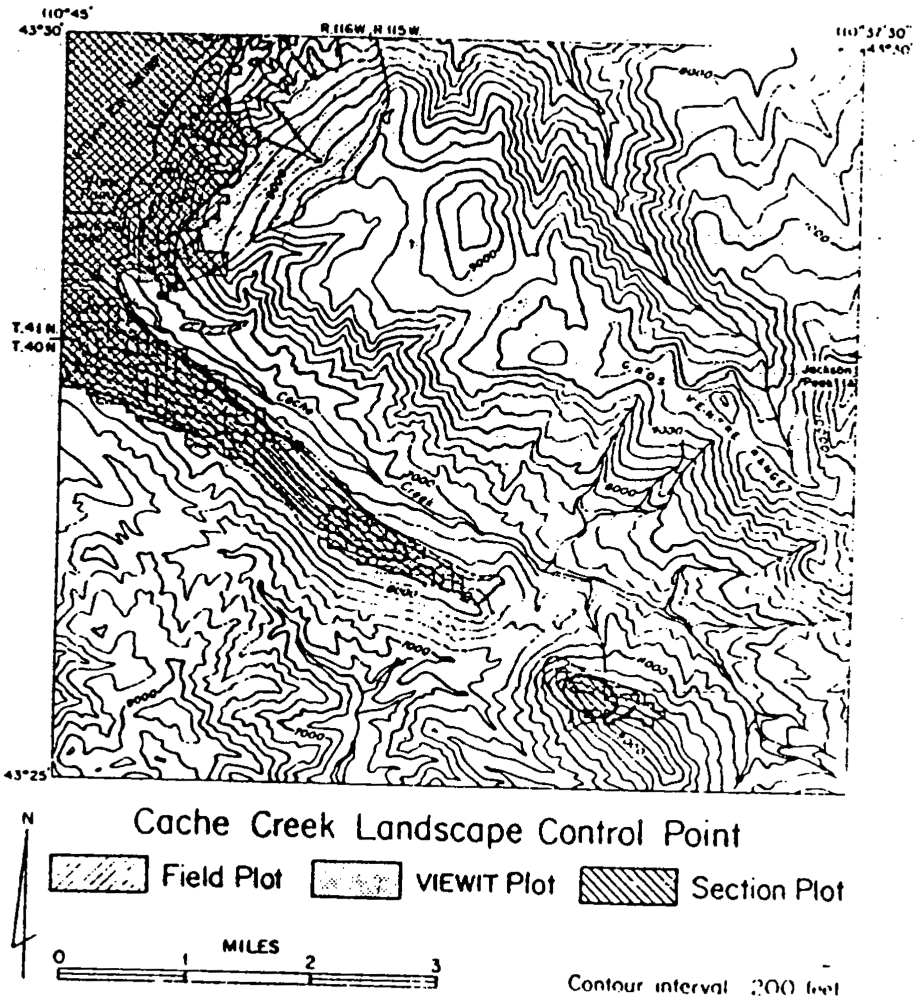


Figure 11—Three ways of map plotting areas visible from a Landscape Control Point: (1) field plotting—direct observations and mapping the visual limits of what is observed; (2) plotting with sections—from a series of sections, lines of sight are drawn to determine visible and invisible areas; (3) computerized plotting, such as VIEWIT—using data on elevations, viewing location, and length of sight line to produce overlays. Photo mosaic shows what is seen from a Landscape Control Point at Cache Creek, Jackson, Wyoming.

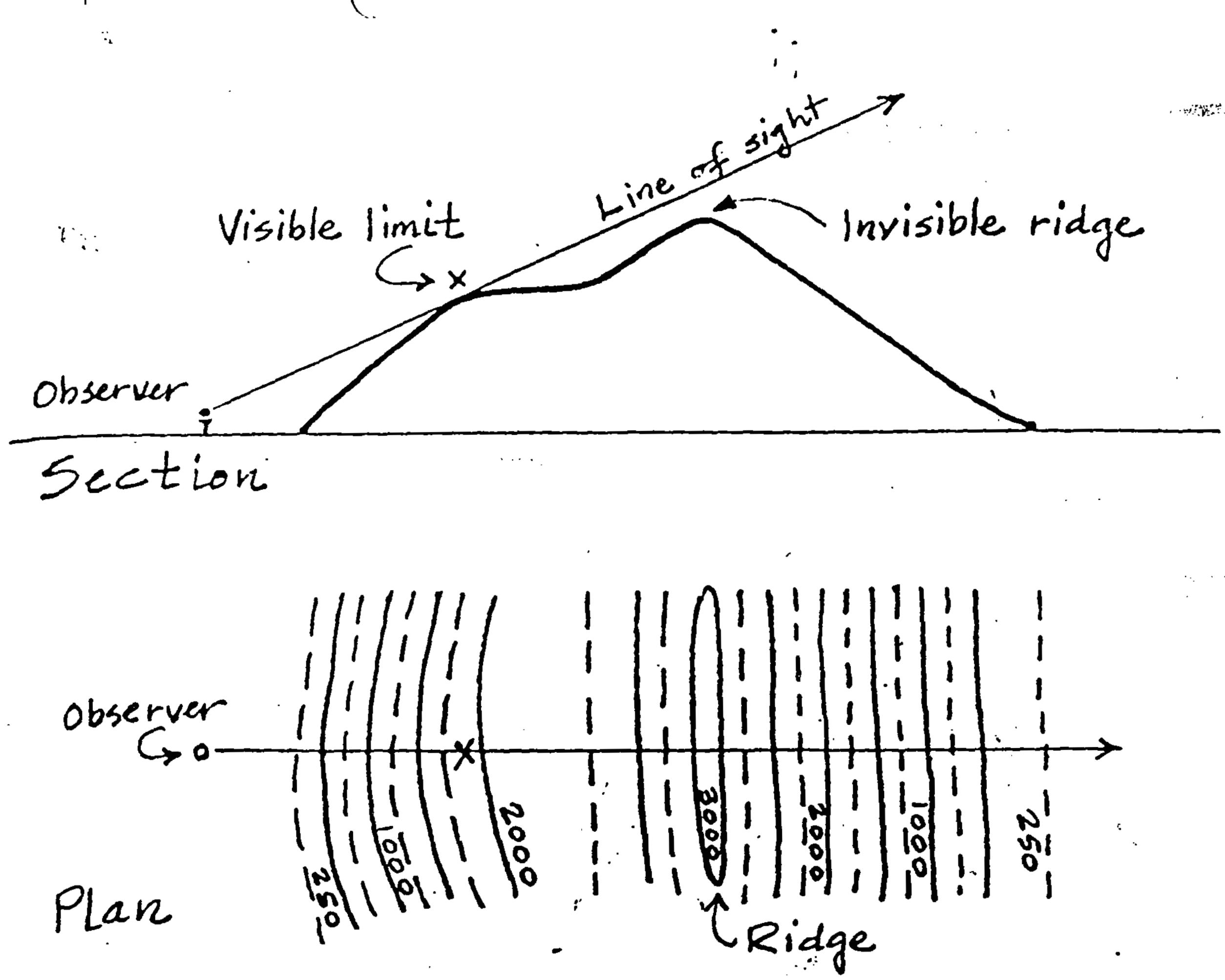


Figure 12—Common error in field plotting. The visible shoulder line is mistaken here for the ridge line.

Direct plotting has certain advantages. The individuals who are doing the work (several people can assist one another in confirming what is observed) must examine the landscape carefully. Peripherally, this approach may be thought of as drawing attention to the landscape as a scenic resource and could serve as an introduction to inventorying the landscape.

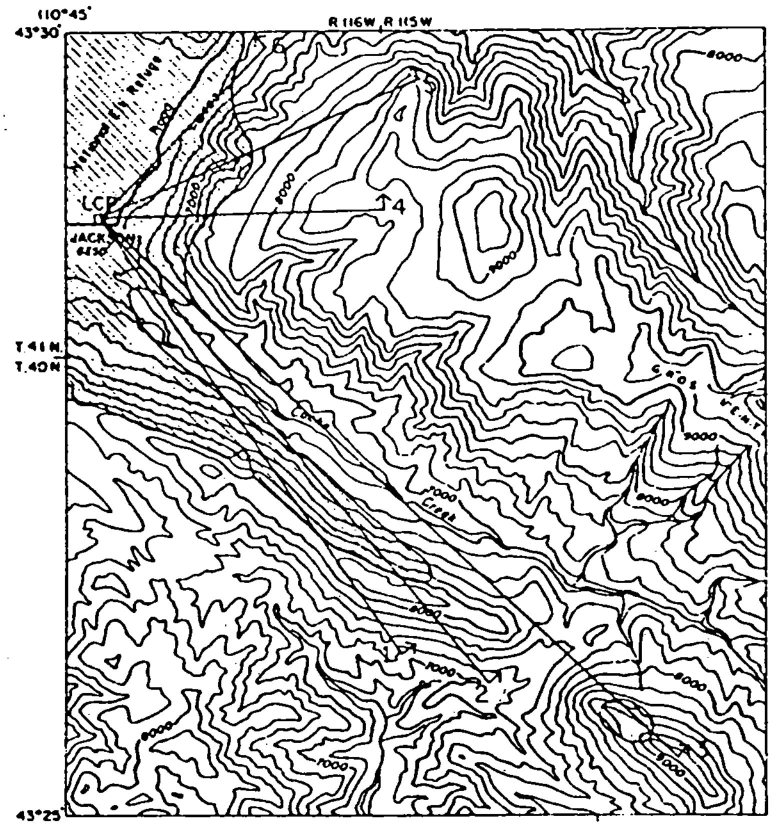
Plotting the sighted visual boundaries should take but little time. The field plot shown in *fig. 11* took 45 minutes at the site. Photography will best be done at the same time as the visual plot so that the two will show similar limits.

Some disadvantages to field plotting may also be noted. It may not be possible or practical to visit the site. Excessive distance or bad weather can well be impediments. Field plotting is done with variable accuracy and efficiency, depending upon the capacity and tendency of individuals. Furthermore the method is imprecise. The identification of all small invisible pockets should be considered impossible. And even if it were accomplished, it would not materially improve upon the generalized location of sighted limits. Plotting visual boundaries is only a means of indicating a particular area which may be subjected to various future manipulations.

Observers in the field will tend to overestimate visible limits. In *fig. 11*, the field plot embraces a larger area than either of the plots made by other two methods. This is most apt to be explained by thinking that ridge lines rather than shoulder lines are visual limits as the plotter looks for coordination between the map and the observed landscape *(fig. 12)*. Additionally, invisible pockets—or some of them—are not readily apparent in the field.

Plotting with Sections

Visual limits may be plotted from a series of sections laid out as rays from a single LCP *(fig. 13)*. With a U.S.G.S. 7½-minute topographic map, an LCP serves as the point of origin for whatever number of sections may be needed to define and locate a visual



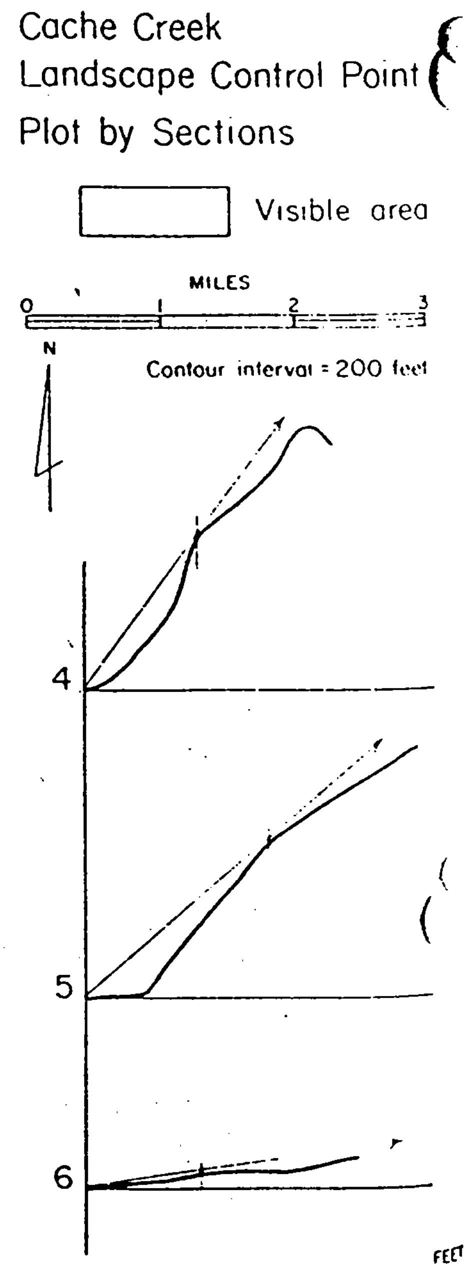
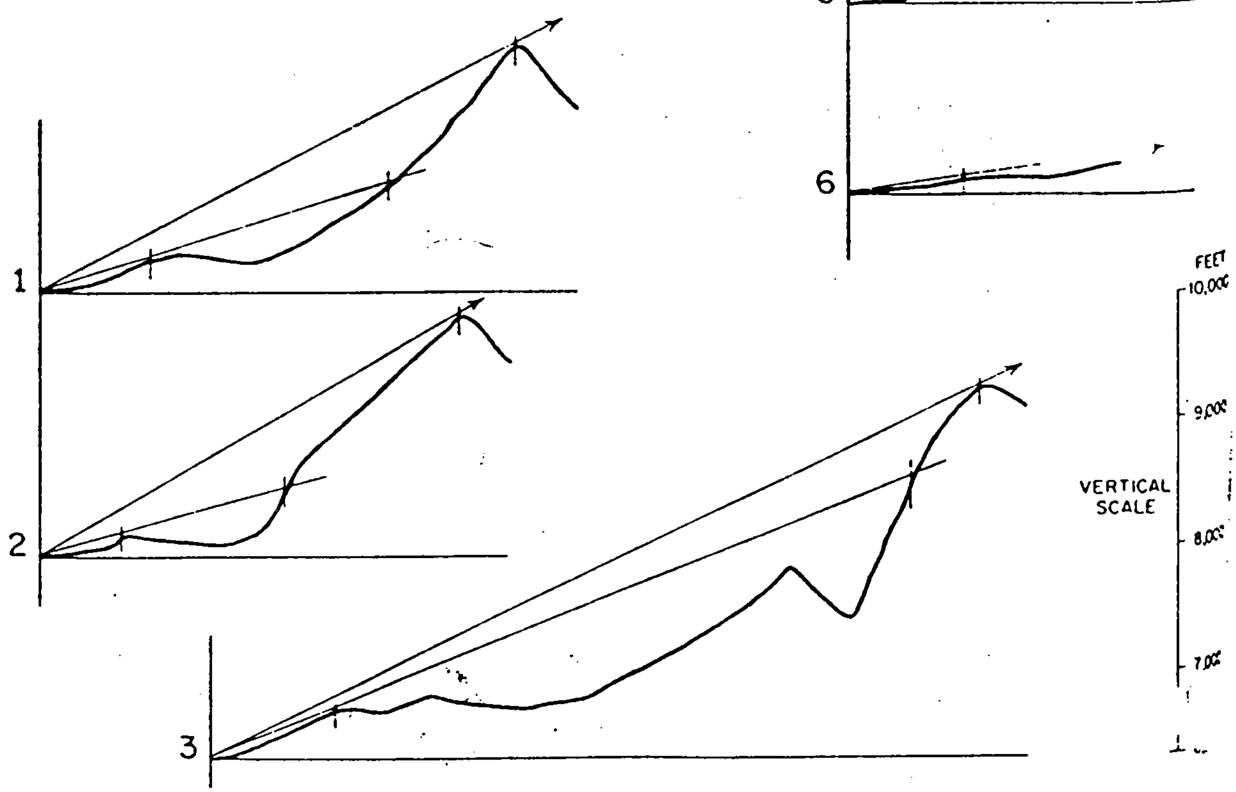


Figure 13—Plotting with sections from a Landscape Control Point at Cache Creek, Jackson, Wyoming. A series of sections are laid out as rays from the LCP. Lines of sight extend from each section. Extent of visible areas is plotted on a topographic map.



boundary in plan. On each section, lines of sight are drawn so that the extent of both visible and invisible areas may be determined. These results are then transferred back to the plan (topographic map) and point locations are connected by lines.

How many sections are needed to locate a plan line? Close examination of the particular topography involved will serve as a guide to both location and number of sections. Placement should particularly reflect characteristics of ridges: Their peaks, saddles and low points, beginnings or ends and changes of direction. Where valleys (enclosed landscapes or lake basins) may be screened by surrounding land forms, sections need to be located so that hidden pockets can be defined. So that topographic variations may be better reflected in sections for more accurate plan plotting, graphic sections should be vertically exaggerated two to five times the horizontal scale. (At a vertical scale of 1 inch = 800 ft., graphic accuracy in plotting will be about ± 20 feet in elevation.)

Although it is possible to make a visibility plot by exclusive use of sections, they may also be useful in an auxiliary way. A field plot could be completed or its accuracy checked by constructing sections. This method combines several advantages: field reality (sense of the landscape) with the control of the graphic sections.

Sectional plotting can be done in the office. Travel to the actual area is not necessary. Therefore, both travel time and cost are avoided. Those necessary weather conditions for satisfactory field work do not have to be met since the office procedure can be a rainy day job.

The construction of sections and their application to defining visible areas is a simple undertaking. Only a minimum of instruction and minimum drafting ability are required. Drafting tools and supplies are those that would normally be on hand in any office. More tenacity than skill is involved. The only absolute necessity for going ahead is availability of topographic maps.

Plotting with sections has certain limitations. Sections and their related LCP determined wholly from a topographic map may not reflect actual landscape visibility. The LCP could be screened by vegetation or by terrain detail going undetected because of a gross contour interval. This limitation should again confirm desirability of combining the sectioning procedure with some knowledge of field conditions so as to avoid errors of judgment.

Sectional plotting in the office avoids cost and time spent in travel to a field point, but is a time-consuming job. Amidon and Elsner (1968) indicate that "the cost of constructing hundreds of profiles (sections) would be. . .prohibitive." Cost comparisons among the three plotting methods are not known except that for *fig. 11* (Cache Creek LCP), the field plot took 45 minutes and the sectioning plot (eight sections) took 1½ hours. Coding the Cache Creek 7½-minute quadrangle map required 8 hours, and the computer time for the single LCP printout was 15 seconds. In addition, the computer data base may be used for 11,288 different visibility plots as each coded cell may represent an LCP (i.e., another plot) while each of the other two methods gives only one plot.

Computerized Plotting

Computation of terrain visible from a given point can be done by employing VIEWIT, a FORTRAN subprogram developed by Amidon and Elsner (1968). The input consists of elevations put into a coordinate system, and the selection of a viewing point, location and length of sight line. The end product is an overlay map.

In principle, plotting by sections and the VIEWIT procedure are similar. Lines of sight scan surrounding land forms and higher elements screen out lower elements.

The 7½-minute topographic map is again the source of data *(fig. 14)*. A grid is prepared with coordinates corresponding to the printing scale of six characters per inch vertically and five per inch horizontally. In this case, the grid or cell size is equal to two characters and covers 3.1 acres. For each cell, elevation was estimated by interpolation to the nearest 100 feet and is represented by two digits.

Translation of the topographic data may also be through the digitizer tracing contours. Each cell which is intersected by a contour is given that particular elevation to the nearest foot. Empty cells can be filled by interpolation of data in surrounding cells. The digitizer will simplify and speed up the elevation coding.

The major advantage of the VIEWIT procedure is the flexibility offered in plotting viewed areas as seen from any observation point (any cell) of a given matrix which has been coded. Once the elevational information has been gathered, any LCP and viewing distance may be chosen.

Other advantages are similar to those for sectional plotting. VIEWIT is an office procedure; it is economical in its efficiency, speed and flexibility. In theory, it requires no field work, but in practical application it should be used with field observations—materially shortening and simplifying field work.

The disadvantages of the VIEWIT procedure are, again, similar to those for sectional plotting. Actual visibility from a selected LCP may be screened by topography or vegetation that is not shown on the base map. For known vegetation, allowances ca[n be] made.

With more facilities obtaining computer service the time, the potential for putting the VIEWIT [pro]gram into effect is easier now than it has ever bee[n]

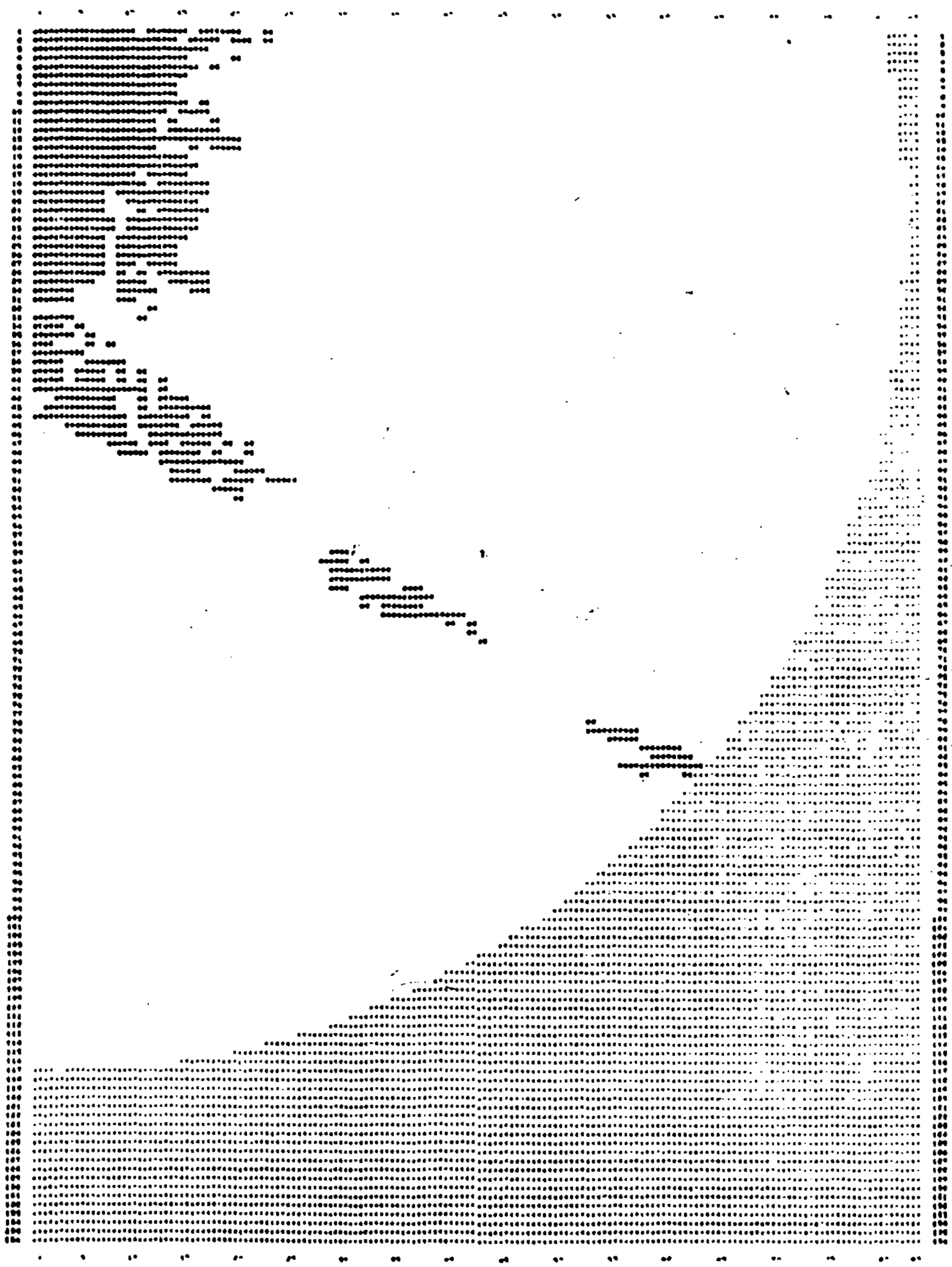


Figure 14—Computerized plotting by VIEWIT program, from a Landscape Control Point at Cache Creek, Jackson, Wyoming. Lines of sight scan the visible area. Data on elevations, by coordinates, are obtained from maps. Each cell in the grid covers 3.1 acres. For each cell, elevation is established by interpolation. The computer produces an overlay that shows the maximum area visible from the LCP.

A CASE STUDY

Teton National Forest

How the five-step procedure in visual analysis can e applied is illustrated by a case study on the Teton lational Forest in Wyoming. The choice of that orest was suggested by a number of reasons. Very eavy tourist and recreation use of the Grand Teton nd Yellowstone National Parks directly and indirect-y involve the Teton Forest. More than 160 miles of State and Federal highways converging upon Jackson Hole and within it either pass through or provide views into this Forest. Air routes coming in and out of Jackson Hole give sweeping overviews of the area.

Jackson Hole is used as a focus and limitation within this report--treating more area only tends to be repetitious. It is of visual significance because it is common to both Grand Teton National Park and the Teton Forest. The basin is readily recognized to be a well defined space. Its floor is primarily open grass-lands or sagebrush, providing unincumbered views of the Teton Range on the west and the lower ridges of the Gros Ventre Range on the east. From 55 percent (72 miles) of the 130 miles of improved or paved roads in Grand Teton Park, it is possible to see an enclosing ridge of the Forest on the east side. Because of heavy travel, it is significant that almost all of the 20 miles of Highway 89-187 between Gros Ventre River and Moran Junction affords eastward views of the Forest. Besides views originating from park roads and turnouts, there are the even more numerous op-portunities of observation from pedestrian locations. Air views, while not emphasized in this paper, are also added to the ground views. It it not unusual to find National Parks surrounded by National Forest lands, but the degree of intervisibility between these two is particularly noteworthy.

Simply because certain areas are visible does not necessarily make them subject to alteration from timber cutting, road construction, or other activities. From within Jackson Hole, four kinds of activities can be observed on the visible slopes of the Forest: roads (State Highway 22, for example), powerline clearings, ski area clearings, and timber cutting. All of them cause visible changes in the surface pattern of the land through removal of vegetation and exposure of soil or sub-soil.

Areas of harvestable trees do remain and are sub-ject to future cutting. A set of strip cuts in lodgepole pine (Curtis Canyon Timber Sale) made between 1956-1963 is visible along Highway 89-187 and espe-cially from the Grand Teton National Park overlook. Public criticism of these conspicuous, manmade strips led to the Forest Supervisor's decision that they should be altered to fit better with the landscape. Such a recut poses what might be called a detail with-in management of the Teton Forest, yet it also raises the general problem of visual control. Additionally, it carries with it the need to recognize and control the visual changes which take place over time as succes-sive cuttings of a working circle occur. This specific recut detail, then, contributed to the suitability of this particular Forest for study.

Application

To cover most of the Teton Forest that may be seen from within Jackson Hole, I set up nine LCPs. Locations were chosen primarily in relation to roads but also to reflect scenic turnouts and other points affording comprehensive views. Where certain views were essentially similar except for the difference of shorter or longer distance to terminal elements, I chose the shorter. As an example, the view toward Sheep Mountain and Jackson Peak from an LCP at Teton Village or one at the south boundary turnout of Grand Teton National Park (at Highway 89-187) is much the same, the difference being that the latter LCP is 5 miles closer to Sheep Mountain and Jackson Peak. From Signal Mountain (LCP No. 2) the maxi-mum sightline distance is 12 miles. However, for all other LCPs, maximum sighting distance varies from 4 to 8 miles. Distances between LCPs are as much as 13 miles and as little as 3½ miles; their combination accounts for a continuously visible strip of landscape, although it contains invisible pockets (or visual voids).

No control points were established along Highway 89 north of Moran Junction, in the vicinity of Jack-son Lake. This is because of virtually complete tree screening along the east and the nearby presence of the Teton Wilderness. But the Teton Forest "corridor"–the National Forest land area between the two national parks along this road represents an especially sensitive management situation which would be a logical area for extension of the Jackson Hole LCP system.

One map *(fig. 15)* includes the framework made by the series of LCPs set up around the perimeter of Jackson Hole. The location of each viewing station and the relationship of one to another can be seen. The scope of view (a range of 75° to 205°) and the area visible from each point can also be seen. Since

the map scale is small, a name was given to each LCP to confirm identity and general location.

Another map with photographic view *(fig. 16)* shows a single LCP imposed on a topographic map of larger scale than *fig. 15*. This LCP is an enlarged version of LCP No. 1 on the framework map. The larger scale plot (approximately 1/2-inch = 1 mile) makes identification possible as based on terrain characteristics. In practice this should be a workable scale for recording LCP coverage and the framework as well. The limitations of size imposed by this study's format precluded showing more than a sample of the LCP plot at this practically useful scale.

A set of four photographic panoramas *(fig. 17)* correspond to the views from four contiguous LCPs numbered 3-6 on the framework map. While these represent only a sample of the LCP views from the framework, they do show connected segments. These photographic panoramas are reduced for printing to a smaller size than practical in actual use. Even the photographic view *(fig. 16)* is only 1/3 the size of a panorama that would be useful in practice. The "working" panorama view needs to show characteristics of the landscape in such size and detail that overlays showing possible alterations are reasonably easy to prepare.

Two field sketches *(figs. 18, 19)* portray detail views taken from LCP No. 6 at the Grand Teton National Park overlook on Highway 187 near the fish hatchery. These pencil studies concentrate on the visual relationships of the Curtis Canyon clearcut strips upon the west slopes of Table Mountain. The cut strips stand out for their own pattern and also assume importance because they occupy a position close to Jackson Peak - a conspicuous feature along this ridge. Detail views may also be prepared photographically by use of a telescopic lens, but there are some advantages to freehand drawings. Sketches can abstract, simplify, and emphasize major characteristics in ways that photographs may not. The sketches are not intended to distort what they represent, b drawings can be a most helpful tool in providing i terpretation of significant landscape characteristic

Two revised sketches *(figs. 20, 21)* show possib ways in which the Curtis Canyon strip cuts *(fig. 1* may be altered. Since the basic purpose of adopting recut pattern here is to achieve a better fit with th landscape, certain of the visual design criteria use need explanation. In looking at the immediate su roundings, the most obvious natural characteristic the expression of horizontal lines—transverse to th strip direction. The long and essentially level lines wil be seen in the ridges above and below the cuttings, i the vegetation edges meeting the upper scree surface and in the edges of the lower grass lands contrasted t conifer forests. Natural openings seen here displa continuity—the connection of one opening t another. The natural openings also tend to have an repeat a lens-like shape as well as a common alignment.

Because the man-made cuttings have a patter which contrast strongly to that of the surrounding they stand out. The suggested sketches rely heavily upon developing both horizontal line emphasis and connection between openings. The changes then seek a unification that can emerge from repeating the concepts seen in certain landscape characteristics of this particular place.

The problem of reworking strip cuts represents a small and atypical application of this visual review procedure, but it does offer a specific demonstration of the concept. Most importantly, the review and criticism of visual alternatives such as these are not merely for selection of the solution which is judged to "look best." The examination of visual displays can, however, lead to constructive refinements incorporating the expertise of various disciplines. If graphic portrayals suggest such impacts as questionable regeneration conditions or erosive runoff, for example, then corrections should be made accordingly.

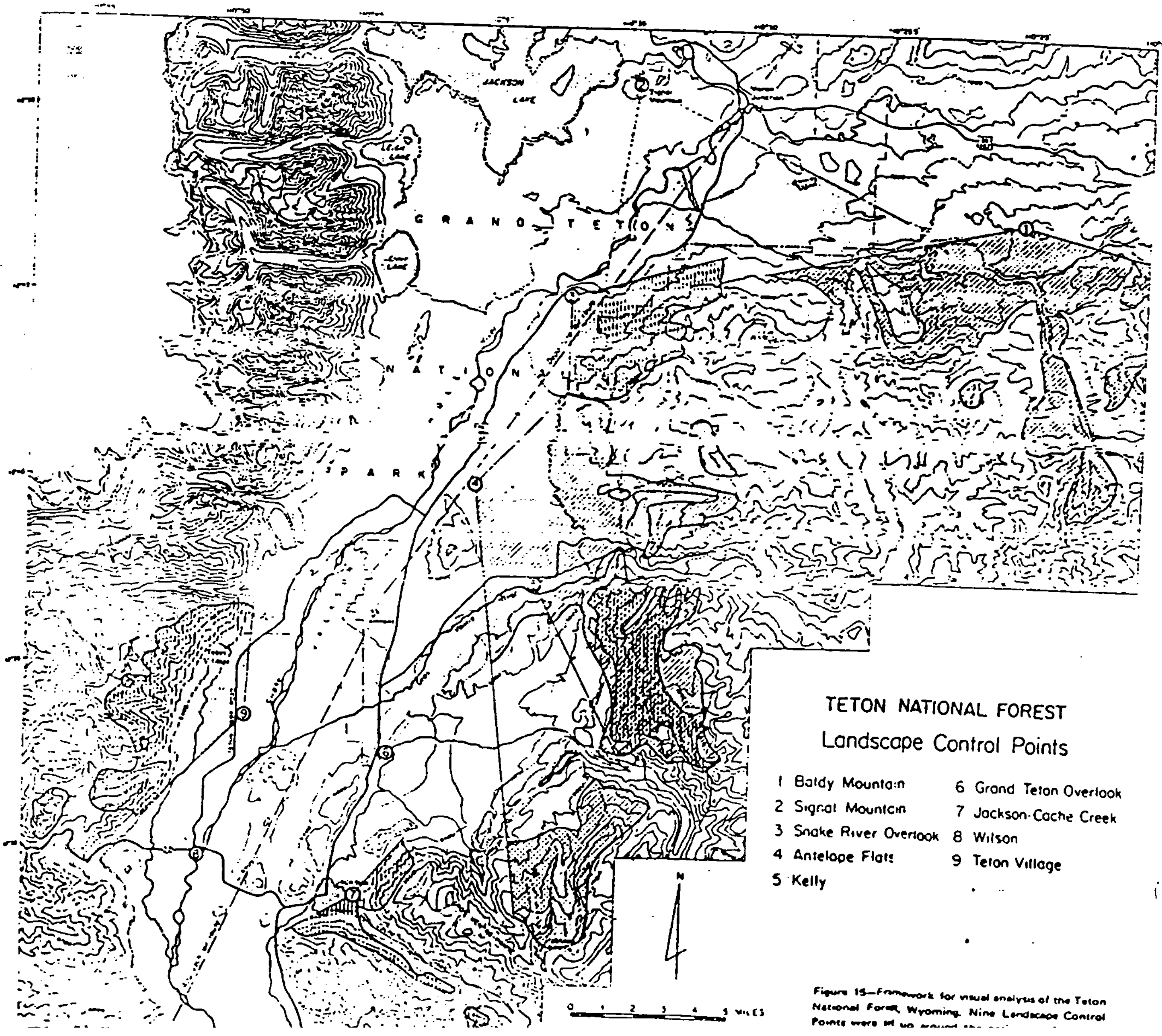
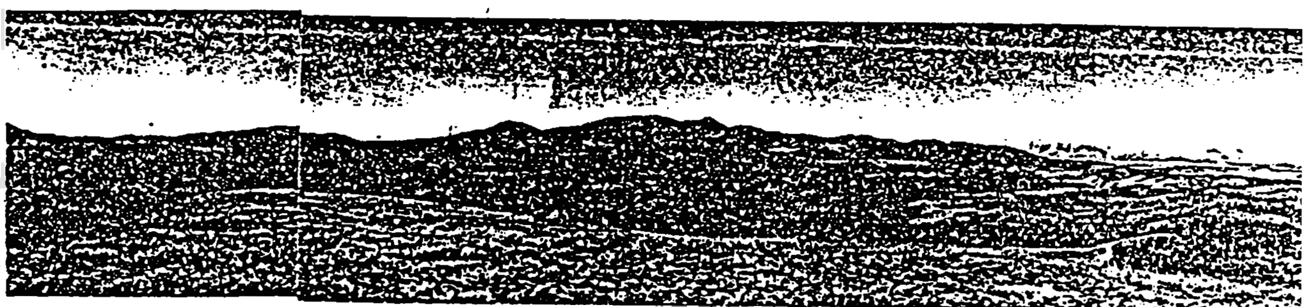


Figure 15—Framework for visual analysis of the Teton National Forest, Wyoming. Nine Landscape Control Points were set up around the ...



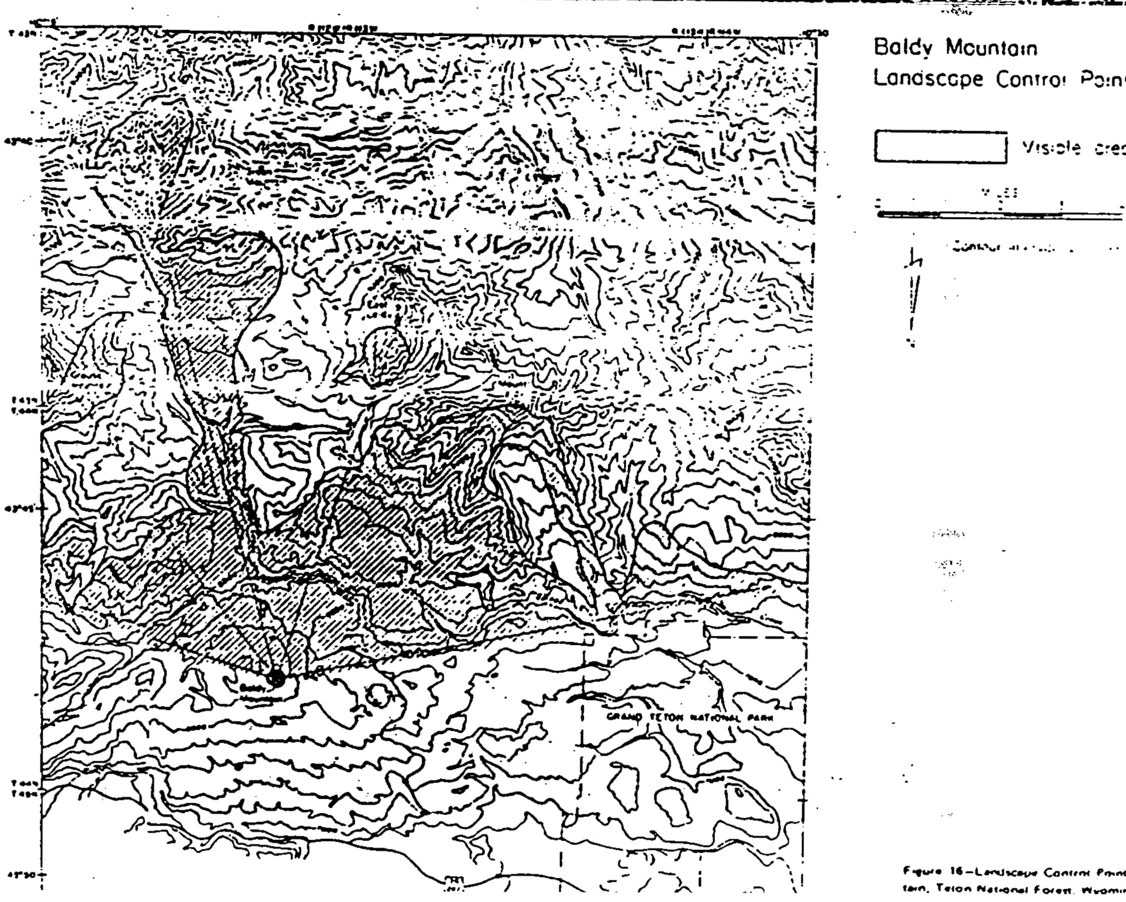
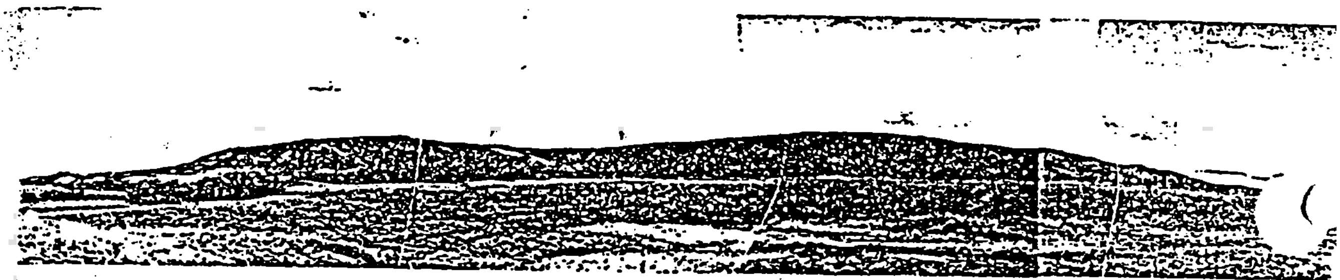


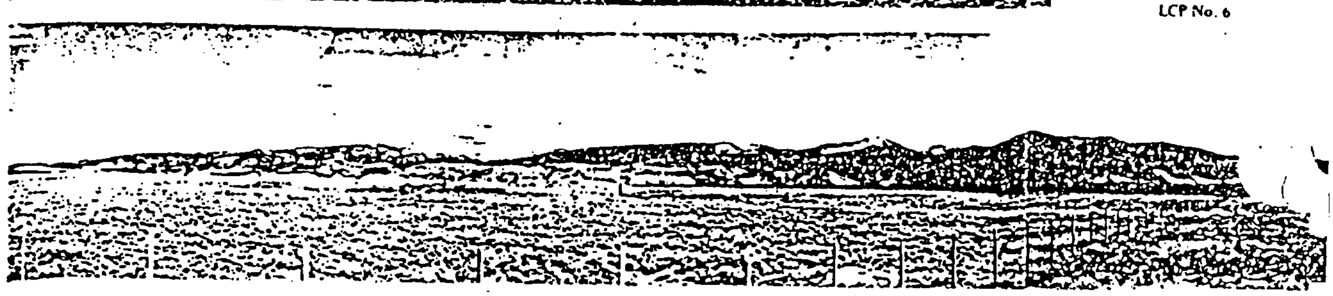
Figure 16—Landscape Control Point at Bal
tain, Teton National Forest, Wyoming, with



LCP No. 3

LCP No. 4

LCP No. 5



LCP No. 6

Figure 17—Four photographic panoramas corresponding to views from four c
tiguous Landscape Control Points (Nos. 3-6 in figure 15), Jackson Hole, Grand

Figure 18—Harvest cuttings at Curtis Canyon, Teton National Forest, Wyoming, as sketched from Landscape Control Point No. 6 (Jackson Peak, and Table Mountain shown) Grand Teton National Park.

Figure 20—[illegible] cuttings at Curtis Canyon, Teton National Forest, Wyoming, could have been altered.

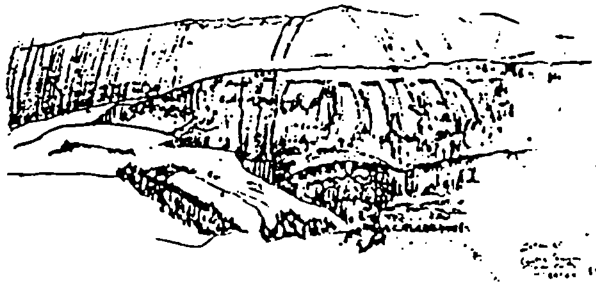


Figure 19—Harvest cuttings at Curtis Canyon, Teton National Forest, Wyoming, as sketched from Landscape Control Point No. 6 (Table Mountain shown) Grand Teton National Park.

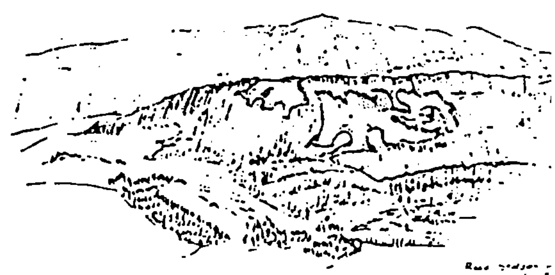


Figure 21—Another alternative in the pattern of cuttings at Curtis Canyon, Teton National Forest, Wyoming, so as to achieve a better fit with the landscape.

SUMMARY AND CONCLUSIONS

Litton, R. Burton, Jr.
1973. Landscape control points: a procedure for predicting and monitoring visual impacts. Pacific Southwest Forest and Range Exp. Stn., Berkeley, Calif. 22 p., illus. (USDA Forest Serv. Res. Paper PSW-91)

Oxford: 907.1:U712.01.
Retrieval Terms: landscape management; visual impact; recreation areas; landscape control points; Teton National Forest.

Landscape Control Points—a network of permanently established observation sites—provide the forest manager with the means of studying the visual impact of alterations to the landscape. Observations are supported by topographic maps, panoramic photographs, sketches, and overlays. Visual analysis of the landscape is done by a five-step procedure: (1) establish a net of Landscape Control Points to provide a reasonably continuous view of the extended area; (2) plot on a topographic map the limits of the visual area seen from each LCP; (3) photograph a panoramic view from each LCP, selecting a suitable time of day and season for each situation; (4) prepare perspective field sketches as a base for more precise studies of possible changes and alternatives; and (5) use the LCPs and graphic information derived from them to project the possible impacts of planned changes.

Criteria for LCPs affecting their location and use involve relationships to roads, trail, air routes, areas of concentrated use, overview covering landscapes of special value, conditions that affect viewing, and overlapping fields of view and different views of the same landscape segment.

Several methods of plotting the visible landscape are available to the forest manager. They include: (a) direct field observation and reference to a topographic map; (b) drawing a series of sections radiating from an LCP, transferring points to a topographic map, and connecting points on the map to form a "sectional plot"; or (c) computing the area visible from one or several LCPs and producing an overlay map by computerized technique.

Use of the LCP framework is primarily concerned with predicting a range of alternative visual impacts upon the landscape. It can also demonstrate that some landscapes (as portrayed from a set of LCPs) are more sensitive to change than others. A case study of visual analysis on the Teton National Forest, Wyoming, illustrates this condition. As the characteristics of sensitive landscapes are better defined and better known, it should lead to better criteria and more exacting management.

Studying alternative kinds of changes, as presented graphically from a specific LCP, allows different disciplines to assess impacts as they may be interpreted from visual displays. This evaluation should offer an opportunity for thinking in visual terms—especially if this is not a typical concern for a given discipline. Using the examples of *fig. 20* and *fig. 21* as but two ways in which cutting patterns might be executed, what might your response be if your field was wildlife management? Silviculture? Hydrology? Engineering and logging technology? Landscape architecture?

If you prefer *fig. 20* over *fig. 21*, the reasons behind your response are what will be of value, not the mere preference. Those representing wildlife, logging systems, fire, and landscape architecture could be expected to have concern for the handling of edges or the relationships between margins and topography. Those representing silviculture, road engineering, soils, disease control, and landscape architecture could be expected to have concern for the size of cuttings, their location and distribution as related to the terrain. Points of agreement, disagreement, and open choice should lead to solutions which combine multidisciplinary objectives within visual end-products.

A visual display by itself may not present enough (or useful) information to a particular respondent. There will be the need to examine the scope of the problem which goes beyond the isolation of the display. Or there may be the need to investigate details that cannot be portrayed by graphically generalized images of the landscape.

Use of the LCP framework and procedure should lead to different disciplines getting together on choices. The more desirable alternatives may result from criteria which come out of the pilot LCP studies or sample applications in specific situations. The feasibility of blanketing a whole forest with LCPs is questionable, and the selection of both typical and critical samples may well be the best way of trying out this means of visual control. If issues are considered sufficiently critical to warrant a complete survey, the LCP method could be applied in a more casual way—yet accounting for special problem situations.

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GPO 7

APPENDIX III

NATIVE SEED SUPPLIERS

(Nebraska and Kansas)

Arrow Seed Co., Inc.
P. O. Box 722
Broken Bow, Nebraska 68822

Bluebird Nursery
Clarkson, Nebraska 68629

CENEX Seed Plant
P. O. Box 279
Gering, Nebraska 69341

CENEX Seed Plant
P. O. Box 1061
Grand Island, Nebraska 68801

Environmental Improvement Service, Inc.
P. O. Box 646
McPherson, Kansas 67460

Hill´s Sod, Trees, and Landscaping
P. O. Box 208
O´Neill, Nebraska 68763

Holdrege Seed and Farm Supply Co.
P. O. Box 530
Holdrege, Nebraska 68949

Horizon Seed Company
1540 Cornhusker Highway
Lincoln, Nebrrska 68521

Sharp Bros. Seed Co.
Healy, Kansas 67401

Stock Seed Farms, Inc.
Route 1, Box 112
Murdock, Nebraska 68407

Wilson Seed Company
Route 1, Box 7
Polk, Nebraska 68654

APPENDIX IV

VEGETATION MANAGEMENT REPORT

Date_______________________Person Filing Report___________________________

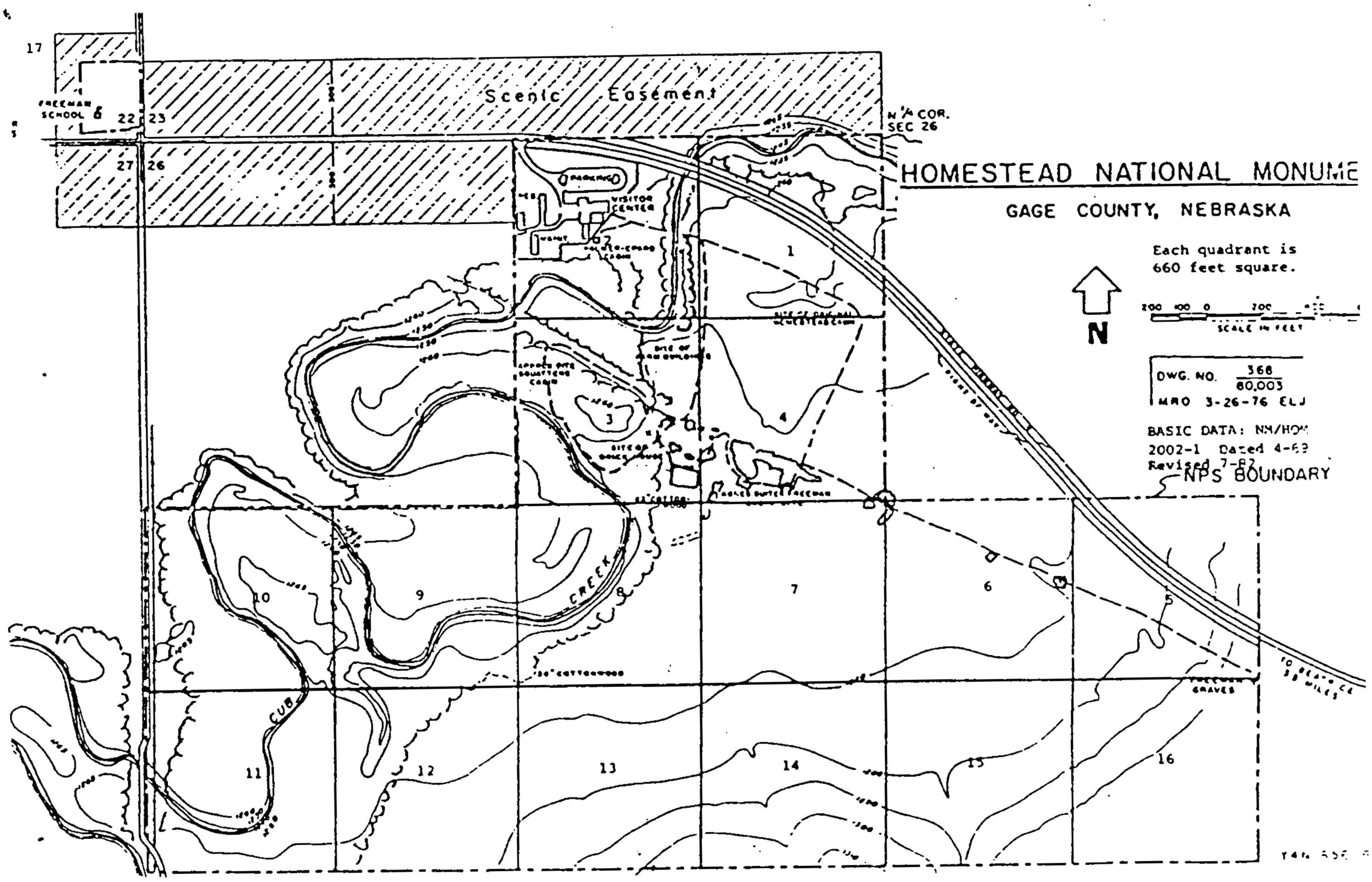
Type of Activity___________________Cross-reference Report File Number:________

Duration of Activity________________Cross-reference Photo Negative Number______

If planting or seeding give source (location); Species, % germination:

If plant removal give type equipment or chemical:

Note location of activity as accurately as possible on the map below. Quadrat(s)_______



File a copy with Vegetation Management Plan

APPENDIX V

COMMON & SCIENTIFIC NAMES OF NEBRASKA PLANTS:
NATIVE & INTRODUCED

Publication Number 101

Nebraska Statewide Arboretum
112 Forestry Sciences Laboratory
UNL-East Campus
Lincoln, NE 68583-0823

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LIST OF CONTRIBUTORS

Peter N. Jensen, Soil Conservation Service, Lincoln, Nebraska
Chairman, NSA Publications Committee

Walter T. Bagley, The University of Nebraska-Lincoln, Lincoln, Nebraska

Margaret R. Bolick, The University of Nebraska-Lincoln, Lincoln, Nebraska

Thomas B. Bragg, The University of Nebraska at Omaha, Omaha, Nebraska

David L. Hintz, Soil Conservation Service, Lincoln, Nebraska

Ole A. Kolstad, Kearney State College, Kearney, Nebraska

Luann M. Leaming, The University of Nebraska-Lincoln, Lincoln, Nebraska

Robert C. Lommasson, The University of Nebraska-Lincoln, Lincoln, Nebraska

Ralph A. Read, U. S. Forest Service (retired), Lincoln, Nebraska

Terrance P. Riordan, The University of Nebraska-Lincoln, Lincoln, Nebraska

Donald H. Steinegger, The University of Nebraska-Lincoln, Lincoln, Nebraska

James L. Stubbendieck, The University of Nebraska-Lincoln, Lincoln, Nebraska

David H. Sutherland, The University of Nebraska at Omaha, Omaha, Nebraska

Keith A. Ticknor, Soil Conservation Service, Lincoln, Nebraska

Curtis M. Twedt, Nebraska Game and Parks Commission, Lincoln, Nebraska

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Cover design by Eloise G. Wilson, Illustrator, UNL, Department of Agricultural Communications

INTRODUCTION

The Nebraska Statewide Arboretum has sponsored this revision of the 1967 publication entitled "Common and Scientific Names of a Selected List of Nebraska Plants, Native and Introduced." Three main parts are included; namely, scientific name, common name, and whether the plant is native to Nebraska. The revision, including the introduction, follows the format of the 1967 list of plants.

A single common name is given for each plant, since common names of plants vary widely between geographic regions and also among local users. A common name may be used for several plant species, such as junegrass, ticklegrass, and wiregrass. This publication attempts to standardize the common name for plants. The common names listed are preferred by the contributors, and it is hoped they will be accepted and used by ranchers, farmers, scientists, researchers, naturalists, students, and all others interested in Nebraska resources. Whenever common names were not known, they were coined using translations, such as "silky aster" for Aster sericeus where "sericeus" is the Latin term for silky.

In preparing the list of plants, an attempt was made to give a single common name to each genus and to use it in conjunction with the common names for each of the species listed under that genus; for example, "grama" for the genus Bouteloua. The complete common name would be blue grama, hairy grama, etc.

The following nine general "rules" are adapted from the U. S. Forest Service Tree and Range Plant Name Committee's introduction to the 1953 edition of the Checklist of Native and Naturalized Trees of the United States (including Alaska), by Elbert L. Little, Jr., of the U. S. Forest Service. There are some exceptions to all of these "rules" but only where firmly established usage should dictate such exceptions.

1. The provincial outlook should be avoided. Names like "tumbleweed" and "wiregrass" may be well understood in a dozen different localities and yet each of these two names might apply to several species in those localities.

   Unless such terms are sanctioned by long usage, less ambigious terms are preferred for indefinite geographical terms, such as "northern" and "southern." One should bear in mind the wide interest in plant names, covering practically all the world and numerous lines of work.

2. The best established usage should be adopted wherever possible and wherever such usage is not definitely in conflict with other essential considerations.

3. The avoidance of homonyms is desirable. That is, the same name should not be used for more than one kind of plant or plant group. For example, only one genus should be called "oak" and only one species of oak should be called "bur oak."

4. Where, under well defined usage, the terminal element of the allotted common name of a genus is properly restricted to another genus, the name should be written solid or if necessary, the name may be hyphenated for readability. For example, the "ash" genus is Fraxinus so "pricklyash" for Zanthoxylum americanum is written solid. "Lily" is Lilium so "blackberry-lily" for Belamcanda is written solid. "Toadflax" is Linaria so "bastard-toadflax" for Comandra is hyphenated.

   Hyphens are used in some cases where they make spelling, meaning, or pronunciation more clearly understood. Some examples of this are "blue-eyedgrass," "dutchmans-breeches," and "snow-on-the-mountain."

5. Some species, for example, redtop in the genus Agrostis and lambsquarters in Chenopodium, have well established names of their own. However, it is desirable to have names on a generic or at least a subgeneric basis. Thus, all species of Fraxinus are various kinds of "ash" and all species of Pinus are various kinds of pine. In a large polytypic genus, such as Prunus, however, whose sections or subgenera are regarded by some botanists as distinct genera, long established usage compels us to recognize subgeneric common names as "cherry" for the section or subgenus Cerasus, "peach" for the section or subgenus Amygdalus, "plum" for true Prunus and so on.

6. Common names for genera should be monomial or at least hyphenated as connating a unit idea corresponding to the monomial Latin generic name; thus "mountain-mahogany" for Cercocarpus and not "mountain mahogany" or "cattail" for Typha and not "cat tail."

7. Nouns are preferable to particles in English specific names; thus "bluntleaf" (rather than "bluntleaved") milkweed, "narrowleaf" (rather than "narowleaved") scurfpea, etc.

8. Where there is possibility of confusion between the name of a person and of an idea or thing, a personal name is written with an "s" without the apostrophe, thus "Shorts milkweed."

9. In general, capitals are avoided for common plant names. They are not used where proper names are combined with words as "grass," "beans," etc.; for examples, "indiangrass," "johnsongrass," "oregongrape," but are used where the name is that of a county, state, or other place and is a separate word; for example, "Virginia wildrye," "Missouri milkvetch," etc.

They are also used where the name is derived from a person's name; for example, "Lambert crazyweed," "Sullivant milkweed," "Torrey pigweed," etc.

Since this is a selected list of both native and introduced species, not all Nebraska plants are included.

An asterisk (*) following the common name indicates the plant is not native to Nebraska; otherwise the plant is native. An "X" before the scientific name indicates the plant is a hybrid and "*" before the scientific name indicates a Nebraska State Plant.

INDEX TO COMMON NAMES

FERNS AND RELATED GENERA
(Lower Vascular Plants)

ADIANTUM pedatum L.	maidenhairfern
ATHYRIUM filix-femina (L.) Roth	ladyfern
AZOLLA mexicana Presl	mosquitofern
BOTRYCHIUM virginianum (L.) Sw.	rattlesnakefern
CHEILANTHES feei Moore	slender lipfern
CYSTOPTERIS Bernh.	bladderfern
bulbifera (L.) Bernh.	bulbet b.
fragilis (L.) Bernh.	fragile b.
protrusa (Weath.) Blasdell	lowland brittlefern
DRYOPTERIS Adans.	shieldfern
cristata (L.) Gray	crested s.
spinulosa (O.F. Muell.) Watt.	spinulose s.
EQUISETUM L.	horsetail; scouringrush
arvense L.	field h.
ferrissii Clute	intermediate s.
fluviatile L.	water h.
hyemale L. var. affine (Engelm.) A.A. Eat. (E. robustum (A. Br.) Engelm.)	tall s.
laevigatum A. Br. (E. kansanum Schaffn.)	smooth s.
ISOETES melanopoda Gay & Durieu	prairie quillwort
MARSILEA vestita Hook. & Grev. (M. mucronata A. Br.)	hairy pepperwort
NOTHOLAENA dealbata (Pursh) Kunze (Pellaea dealbata (Pursh) Prantl.)	cloakfern
ONOCLEA sensibilis L.	sensitivefern
OPHIOGLOSSUM vulgatum L.	adderstonguefern
OSMUNDA L.	floweringfern
cinnamomea L.	cinnamonfern
regalis L.	royalfern
PELLAEA atropurpurea (L.) Link	purple cliffbrake
PILULARIA americana A. Br.	pillwort

POLYSTICHUM Roth.	hollyfern
acrostichoides (Michx.) Schott	christmasfern
setiferum 'Angulare'	alaskafern
SELAGINELLA Beauv.	clubmoss; spikemoss
densa Rydb.	prairie c.
rupestris (L.) Spreng.	rock s.
THELYPTERIS palustris Schott	marshfern
WOODSIA R. Br.	woodsia
obtusa (Spreng.) Torr.	bluntlobe w.
oregana D.C. Eat.	Oregon w.

GRASSES

AEGILOPS cylindrica Host	jointed goatgrass *
AGROHORDEUM macounii (Vasey) LePage	Macoun wildrye
AGROPYRON Gaertn.	wheatgrass; quackgrass
caninum (L.) Beauv.	slender w.
cristatum (L.) Gaertn.	crested w. *
dasystachyum (Hook.) Scribn.	thickspike w.
elongatum (Host) Beauv.	tall w. *
intermedium (Host) Beauv.	intermediate w. *
intermedium (Host) Beauv. var. trichophorum Halac.	pubescent w. *
repens (L.) Beauv.	quackgrass *
smithii Rydb.	western w.
spicatum (Pursh) Scribn. & Smith	bluebunch w.
AGROSTIS L.	bentgrass
exarata Trin.	spike b.
hyemalis (Walt.) BSP	winter b.
hyemalis (Walt.) BSP var. tenuis (Tuckerm.) Gl.	rough b.
palustris Huds.	creeping b. *
stolonifera L.	redtop *
tenuis Sibth.	colonial b. *
ALOPECURUS L.	foxtail
aequalis Sobol.	shortawn f.
arundinaceus Poir.	creeping f.
carolinianus Walt.	Carolina f.
geniculatus L.	water f.
pratensis L.	meadow f.

ANDROPOGON L.	bluestem
gerardi Vitman	big b.
hallii Hack.	sand b.
scoparius (See S. scoparium)	
ARISTIDA L.	threeawn
adscensionis L.	sixweeks t.
basiramea Engelm.	forktip t.
basiramea Engelm. var. curtissii (Gray) Shinners	Curtiss t.
longespica Poir.	slimspike t.
oligantha Michx.	prairie t.
purpurea Nutt.	purple t.
purpurea Nutt. var. longiseta (Steud.) Vasey	Fendler t.
purpurea Nutt. var. robusta (Merr.) A. and N. Holmgren	red t.
AVENA L.	oat
fatua L.	wild o. *
sativa L.	common o. *
BECKMANNIA syzigachne (Steud.) Fern.	American sloughgrass
BOTHRIOCHLOA saccharoides (Sw.) Rydb. (Andropogon saccharoides)	silver bluestem
BOUTELOUA Lag.	grama
curtipendula (Michx.) Torr.	sideoats g.
gracilis (HBK) Griffiths	blue g.
hirsuta Lag.	hairy g.
BRACHYELYTRUM erectum (Schreb.) Beauv.	bearded shorthusk
BROMUS L.	brome; cheat; chess
altissimus Pursh (B. latiglumis)	earleaf b.
biebersteinii Roem. and Schult.	meadow b. *
brizaeformis Fisch. and Mey.	rattle b. *
carinatus Hook. and Arn.	California b.
ciliatus L.	fringed b.
commutatus Schrad.	hairy chess *
inermis Leyss.	smooth b. *
japonicus Thunb.	Japanese b. *
mollis L.	soft c. *
porteri (Coult.) Nash	nodding b.
pubescens Muhl. ex Willd.	Canada b.
secalinus L.	cheat *
squarrosus L.	squarrose b. *
tectorum L.	downy b.
BUCHLOE dactyloides (Nutt.) Engelm.	buffalograss

CALAMAGROSTIS Adans.	reedgrass
canadensis (Michx.) Beauv.	bluejoint r.
stricta (Timm.) Koel	northern r.
CALAMOVILFA longifolia (Hook.) Scribn.	prairie sandreed
CATABROSA aquatica (L.) Beauv.	brookgrass
CENCHRUS longispinus (Hack.) Fern.	field sandbur
CHLORIS Sw.	chloris; windmillgrass
verticillata Nutt.	windmillgrass
virgata Sw.	showy chloris
CINNA arundinacea L.	stout woodreed
CYNODON dactylon (L.) Pers.	bermudagrass *
DACTYLIS glomerata L.	orchardgrass *
DANTHONIA spicata (L.) Beauv.	poverty danthonia
DIARRHENA americana Beauv.	American beakgrain
DICHANTHELIUM (Hitchc. & Chase) Gould	dichanthelium; panicum
acuminatum (Sw.) Gould & Clark (Panicum lanuginosum, P. lanuginosum var. fasciculatum)	woolly d.
acuminatum var. implicatum (Scribn.) Gould & Clark (P. lanuginosum var. implicatum)	tangled d.
acuminatum var. lindheimeri (Nash) Gould and Clark (P. lanuginosum var. lindheimeri)	Lindheimer d.
acuminatum var. villosum (A. Gray) Gould and Clark (P. praecocius)	white-haired d.
latifolium (L.) Gould & Clark (P. latifolium)	broadleaf d.
leibergii (Vasey) Freckmann (P. leibergii)	Leiberg d.
linearifolium (Scribn.) Gould (P. perlongum)	slimleaf d.
oligosanthes (Schult.) Gould var. scribnerianum (Nash) Gould	Scribner d.
oligosanthes (Schult.) Gould var. wilcoxianum (Vasey) Gould & Clark (P. wilcoxianum)	Wilcox d.
sphaerocarpon (Ell.) Gould (P. sphaerocarpon)	roundseed d.

DIGITARIA Heist.	crabgrass
ciliaris (Retz.) Koel.	southern c. *
ischaemum (Schreb.) Muhl.	smooth c. *
sanguinalis (L.) Scop.	hairy c. *
DISTICHLIS spicata (L.) Greene var. stricta (Torr.) Beetle	inland saltgrass
ECHINOCHLOA Beauv.	barnyardgrass
crusgalli (L.) Beauv.	common b.
muricata (Beauv.) Fern.	rough b.
muricata (Beauv.) Fern. var. microstachya Wieg.	smallflower b.
ELEUSINE indica (L.) Gaertn.	goosegrass *
ELYMUS L.	wildrye
canadensis L.	Canada w.
cinereus Scribn. & Merr.	giant w.
junceus Fisch.	Russian w. *
villosus Muhl.	hairy w.
virginicus L.	Virginia w.
ERAGROSTIS Beauv.	lovegrass
capillaris (L.) Nees	lacegrass
cilianensis (All.) E. Mosher	stinkgrass *
frankii C.A. Meyer	sandbar l.
hypnoides (Lam.) BSP	teal l.
pectinacea (Michx.) Nees	Carolina l.
pilosa (L.) Beauv.	India l. *
reptans (Michx.) Nees	creeping l.
spectabilis (Pursh) Steud.	purple l.
trichodes (Nutt.) Wood	sand l.
ERIANTHUS ravennae (L.) Beauv.	ravennagrass
ERIOCHLOA contracta Hitchc.	prairie cupgrass
FESTUCA L.	fescue
amethystina L.	large blue fescue *
arundinacea Schreb.	tall f. *
obtusa Biehler	nodding f.
octoflora Walt. (Vulpia octoflora)	sixweeks f.
ovina var. durinschula (Lam.) Koch	hard f. *
ovina var. glauca (Lam.) Koch	dwarfblue f. *
ovina L. var. rydbergii St. Yves	sheep f.
paradoxa Desv.	cluster f.
pratensis Huds.	meadow f. *
rubra L.	red f.
rubra var. commutata Gaud.	chewings f. *

GLYCERIA R. Br.	mannagrass
borealis (Nash) Batch.	northern m.
grandis S. Wats.	American m.
striata (Lam.) Hitchc.	fowl m.
HORDEUM L.	barley
jubatum L.	foxtail b.
pusillum Nutt.	little b.
vulgare L.	field b. *
HYSTRIX patula Moench	bottlebrushgrass
KOELERIA pyramidata (Lam.) Beauv.	prairie junegrass
LEERSIA Sw.	cutgrass
oryzoides (L.) Sw.	rice c.
virginica Willd.	whitegrass
LEPTOCHLOA fascicularis (Lam.) Gray	bearded spangletop
LEPTOLOMA cognatum (Schult.) Chase	fall witchgrass
LEUCOPOA kingii (S. Wats.) W. Weber	spikefescue
LOLIUM L.	ryegrass
perenne L. var. aristatum Willd.	Italian r. *
perenne L. var. perenne	perennial r. *
MELICA nitens (Scribn.) Nutt.	threeflower melic
MISCANTHUS sacchariflorius (Maxim.) Hack.	silvergrass *
sinensis Anderss.	eulaliagrass *
MUHLENBERGIA Schreb.	muhly
asperifolia (Nees & Meyen) Parodi	alkali m.
bushii Pohl	nodding m.
cuspidata (Torr.) Rydb.	plains m.
filiformis (Thurb.) Rydb.	pullup m.
frondosa (Poir.) Fern.	wirestem m.
glomerata (Willd.) Trin.	roundhead m.
mexicana (L.) Trin.	Mexican m.
minutissima (Steud.) Swallen	annual m.
pungens Thurb.	sandhill m.
racemosa (Michx.) BSP	marsh m.
richardsonis (Trin.) Rydb.	mat m.
schreberi Gmel.	nimblewill
sobolifera (Muhl.) Trin.	rock m.
sylvatica Torr.	forest m.
tenuiflora (Willd.) BSP	slimflower m.
torreyi (Kunth) Hitchc.	ring m.

MUNROA squarrosa (Nutt.) Torr.	falsebuffalograss
ORYZOPSIS Michx.	ricegrass
hymenoides (R. & S.) Ricker	Indian r.
micrantha (Trin. & Rupr.) Thurb.	littleseed r.
racemosa (Sm.) Ricker	blackseed r.
PANICUM L. (See Dichanthelium species)	panicum
capillare L.	common witchgrass
dichotomiflorum Michx.	fall p.
miliaceum L.	proso *
virgatum L.	switchgrass
PASPALUM setaceum Michx. var. stramineum (Nash) D. Banks	sand paspalum
PENNISETUM alopecuroides (L.) Spreng.	fountaingrass *
PHALARIS L.	canarygrass
arundinacea L.	reed c.
canariensis L.	canarygrass
PHLEUM pratense L.	timothy *
PHRAGMITES australis (Cav.) Trin.	common reed
POA L.	bluegrass
annua L.	annual b. *
arida Vasey	plains b.
bulbosa L.	bulbous b. *
canbyi (Scribn.) Piper	Canby b.
chapmaniana Scribn.	Chapman b.
compressa L.	Canada b. *
fendleriana (Steud.) Vasey	mutton b.
glaucifolia Scribn. & Will.	waxy b.
interior Rydb.	inland b.
juncifolia Scribn.	alkali b.
palustris L.	fowl b.
pratensis L.	Kentucky b. *
sandbergii Vasey	Sandberg b.
sylvestris Gray	woodland b.
trivialis L.	rough b. *
POLYPOGON monspeliensis (L.) Desf.	rabbitfootgrass *
PUCCINELLIA Parl.	alkaligrass
distans (L.) Parl.	weeping a. *
nuttallii (Schult.) Hitchc.	Nuttall a.
REDFIELDIA flexuosa (Thurb.) Vasey	blowoutgrass

SCHEDONNARDUS paniculatus (Nutt.) Trel.	tumblegrass
SCHIZACHNE purpurascens (Torr.) Swallen	falsemelic
*SCHIZACHYRIUM scoparium (Michx.) Nash (Andropogon scoparius)	little bluestem
SCOLOCHLOA festucacea (Willd.) Link	rivergrass
SECALE cereale L.	rye *
SETARIA Beauv.	bristlegrass
faberi Herrm.	giant b. *
glauca (L.) Beauv.	yellow b. *
italica (L.) Beauv.	foxtail millet *
verticillata (L.) Beauv.	hooked b. *
viridis (L.) Beauv.	green b. *
SITANION hystrix (Nutt.) Sm. var. brevifolium (Sm.) C.L. Hitchc.	squirreltail
SORGHASTRUM nutans (L.) Nash	indiangrass
SORGHUM Moench	sorghum
bicolor (L.) Moench	sorghum *
halepense (L.) Pers.	johnsongrass *
vulgare Pers. var. sudanense Hitchc.	sudangrass *
SPARTINA Schreb.	cordgrass
gracilis Trin.	alkali c.
pectinata Link	prairie c.
SPENOPHOLIS Scribn.	wedgegrass
obtusata (Michx.) Scribn.	prairie w.
obtusata (Michx.) Scribn. var. major (Torr.) Erdman	slender w.
SPOROBOLUS R. Br.	dropseed
airoides (Torr.) Torr.	alkali sacaton
asper (Michx.) Kunth	tall d.
cryptandrus (Torr.) Gray	sand d.
heterolepis (Gray) Gray	prairie d.
neglectus (Nash) Scribn.	puffsheath d.
texanus Vasey	Texas d.
vaginiflorus (Torr.) Wood	poverty d.

*Nebraska State Grass

STIPA L.	needlegrass
comata Trin. & Rupr.	needleandthread
pennata L.	European feathergrass *
spartea Trin.	porcupinegrass
viridula Trin.	green n.
TRIDENS flavus (L.) Hitchc.	purpletop
TRIPLASIS purpurea (Walt.) Chapm.	purple sandgrass
TRIPSACUM dactyloides L.	eastern gamagrass
TRITICUM aestivum (L.) L.	wheat *
ZEA mays L.	corn *
ZIZANIA aquatica L.	annual wildrice
ZOYSIA japonica Steud.	zoysia *

SEDGES, RUSHES, AND REALTED GENERA

BULBOSTYLIS capillaris (L.) Clarke	threadleaf beakseed
CAREX L.	sedge
amphibola Steud.	narrowleaf s.
aquatilis Wahl.	water s.
atherodes Spreng.	awned s.
aurea Nutt.	golden s.
bebbii Olney	Bebb s.
blanda Dewey	woodland s.
brevior (Dewey) Mackenz.	fescue s.
cephalophora Muhl.	woodbank s.
comosa Boott	bristly s.
cristatella Britt.	crested s.
diandra Schrank	twostamen s.
douglasii Boott	Douglas s.
eburnea Boott	ivory s.
eleocharis Bailey	needleleaf s.
filifolia Nutt.	threadleaf s.
granularis Muhl.	meadow s.
gravida Bailey	heavy s.
heliophila Mackenz.	sun s.
hystericina Muhl.	bottlebrush s.
interior Bailey	inland s.
lacustris Willd.	lakebank s.
laeviconica Dewey	smooothcone s.
lanuginosa Michx.	woolly s.
meadii Dewey	Mead s.

molesta Mackenz.	shaggy s.
muhlenbergii Schk.	Muhlenberg s.
nebraskensis Dewey	Nebraska s.
parryana Dewey	Parry s.
praegracilis Boott	slender s.
prairea Dewey	prairie s.
rosea Schk.	rose s.
saximontana Mackenz.	Rocky Mountain s.
scoparia Schk.	broom s.
sparganioides Muhl.	burreed s.
sprengelii Dewey	longbeak s.
squarrosa L.	squarrose s.
stipata Muhl.	awlfruit s.
stricta Lam.	tussock s.
tetanica Schk.	rigid s.
tribuloides Wahl.	bristlebract s.
viridula Michx.	green s.
vulpinoidea Michx.	fox s.
CYPERUS L.	flatsedge
acuminatus Torr. & Hook	tapeleaf f.
aristatus Rottb.	awned f.
diandrus Torr.	low f.
engelmanni Steud.	Engelmann f.
erythrorhizos Muhl.	redfoot f.
esculentus L.	chufa f.
ferruginescens Boeck.	slender f.
filiculmis Vahl	fern f.
rivularis Kunth	brook f.
schweinitzii Torr.	Schweinitz f.
strigosus L.	strawcolor f.
DULICHIUM arundinaceum (L.) Britt.	dulichium
ELEOCHARIS R. Br.	spikesedge
acicularis (L.) R. & S.	needle s.
atropurpurea (Retz.) Kunth	purple s.
compressa Sulliv.	flatstem s.
erythropoda Steud.	creeping s.
obtusa (Willd.) Schult.	blunt s.
palustris (L.) R. & S.	common s.
tenuis (Willd.) Schult.	slender s.
ERIOPHORUM L.	cottongrass
angustifolium Honckeny	tall c.
gracile Koch	slender c.
virginicum L.	Virginia c.
FIMBRISTYLIS Vahl	fimbristylis
caroliniana (Lam.) Fern.	inland f.
puberula (Michx.) Vahl	hairy f.

FUIRENA Rottb.	fuirena
simplex Vahl	smooth f.
squarrosa Michx.	hairy f.
HEMICARPHA Nees	hemicarpha
aristulata (Coville) Smyth	awned h.
micrantha (Vahl) Britt.	common h.
JUNCUS L.	rush
alpinus Vill.	alpine r.
balticus Willd.	Baltic r.
brachyphyllus Wieg.	shortleaf r.
bufonis L.	toad r.
canadensis J. Gay	Canada r.
dudleyi Wieg.	Dudley r.
filiformis L.	thread r.
interior Wieg.	inland r.
longistylis Torr.	longstyle r.
marginatus Rostk.	grassleaf r.
nodosus L.	jointed r.
scirpoides Lam.	scirpuslike r.
tenuis Willd.	slender r.
torreyi Coville	Torrey r.
SCIRPUS L.	bulrush
acutus Muhl.	hardstem b.
americanus Pers.	American b.
atrovirens Willd.	green b.
fluviatilis (Torr.) Gray	river b.
hallii Gray	Hall b.
heterochaetus Chase	slender b.
paludosus A. Nels.	alkali b.
validus Vahl	softstem b.

OTHER MONOCOTS
(Except Grasses, Sedges, Rushes, and Related genera)

ACORUS calamus L.	sweetflag *
ALISMA L.	waterplantain
gramineum Gmel.	narrowleaf w.
plantago-aquatica L.	waterplantain
subcordatum Raf.	subcordate w.
ALLIUM L.	onion; garlic
canadense L.	Canada o.
cepa L.	onion *
cernuum Roth	nodding o.
stellatum Ker	prairie o.

textile A. Nels. & Macbr.	textile o.
vineale L.	field g. *
ARISAEMA Mart.	jack-in-the-pulpit
dracontium (L.) Schott	dragonroot j.
triphyllum (L.) Schott	Indian j.
ASPARAGUS officinalis L.	asparagus *
BELAMCANDA chinensis (L.) DC.	blackberrylily
CALOCHORTUS Pursh	mariposalily
gunnisonii S. Wats.	Gunnison m.
nuttallii T. & G.	Nuttall m.
COMMELINA L.	dayflower
communis L.	common d. *
diffusa Burm. f.	spreading d. *
erecta L.	erect d.
CONVALLARIA majalis L.	lily-of-the-valley
CYPRIPEDIUM L.	ladyslipper
calceolus L.	small yellow l.
candidum Muhl.	white l.
ECHINODORUS rostratus (Nutt.) Engelm.	burhead
ELODEA Michx.	elodea
canadensis Michx.	elodea
nuttallii (Planch.) St. John	Nuttall e.
ERYTHRONIUM L.	fawnlily
albidum Nutt.	white f.
mesochoreum Knerr	prairie f.
GALANTHUS nivalis L.	common snowdrop
HABENARIA Willd.	habenaria
hyperborea (L.) R. Br.	green h.
leucophaea (Nutt.) Gray	prairie h.
HEMEROCALLIS fulva L.	daylily *
HETERANTHERA R. & P.	mudplantain
dubia (Jacq.) MacMill.	waterstargrass
limosa (Sw.) Willd.	shore m.
HYPOXIS hirsuta (L.) Coville	hypoxis

IRIS (Tourn.) L.	iris
missouriensis Nutt.	Missouri i.
sibirical L.	Siberian i.
versicolor L.	blueflag i.
LEMNA L.	duckweed
gibba L.	swollen d.
minor L.	common d.
perpusilla Torr.	minute d.
trisulca L.	star d.
LEUCOCRINUM montanum Nutt.	sandlily
LILIUM L.	lily
canadense L.	Canada l.
philadelphicum L.	western wood l.
NAJAS L.	naiad
flexilis (Willd.) Rostk. & Schmidt	northern n.
guadalupensis (Spreng.) Magnus	southern n.
ORCHIS spectabilis L.	showy orchis
POLYGONATUM biflorum (Walt.) Ell.	solomonseal
POTAMOGETON L.	pondweed
amplifolius Tuckerm.	largeleaf p.
crispus L.	curlyleaf p.
diversifolius Raf.	waterthread p.
foliosus Raf.	leafy p.
gramineus L.	variableleaf p.
illinoensis Morong	Illinois p.
natans L.	floatingleaf p.
nodosus Poir.	longleaf p.
pectinatus L.	sago p.
perfoliatus L.	claspingleaf p.
pusillus L.	baby p.
zosteriformis Fern.	flatstem p.
RUPPIA maritima L.	widgeongrass
SAGITTARIA L.	arrowhead
cuneata Sheldon	duckpotato a.
graminea Michx.	narrowleaf a.
latifolia Willd.	common a.
montevidensis Schlect. & Cham.	giant a.
rigida Pursh	stiff a.
SISYRINCHIUM L.	blue-eyedgrass
angustifolium Miller	common b.
campestre Bickn.	prairie b.

SMILACINA Desf.	solomonplume
racemosa (L.) Desf.	feather s.
stellata (L.) Desf.	starry s.
SMILAX L.	greenbriar
herbacea L.	carrionflower
hispida Muhl.	bristly g.
SPARGANIUM eurycarpum Engelm.	giant burreed
SPIRANTHES cernua (L.) Rich.	nodding ladiestresses
SPIRODELA polyrhiza (L.) Schleid.	common ducksmeat
TRADESCANTIA L.	spiderwort
bracheata Small	bracted s.
occidentalis (Britt.) Smyth	prairie s.
virginiana L.	Virginia s.
TRIGLOCHIN maritimum L.	arrowgrass
TYPHA L.	cattail
angustifolia L.	narrowleaf c.
latifolia L.	common c.
WOLFFIA Horkel	wolffia
columbiana Karst.	common w.
punctata Griseb.	dotted w.
YUCCA glauca Nutt.	small soapweed
ZANNICHELLIA palustris L.	horned-pondweed
ZIGADENUS Michx.	deathcamas
elegans Pursh	white d.
venenosus S. Wats.	grassy d.

LEGUMES
(Including Woody Species)

AMORPHA L.	leadplant; indigobush
canescens Pursh	leadplant
fruticosa L.	indigobush
nana Nutt.	dwarf l.
AMPHICARPA bracteata (L.) Fern.	southern hogpeanut
APIOS americana Medic.	American potatobean

ASTRAGALUS L.	loco; milkvetch
adsurgens Pall. var. robustior Hook.	prairie m.
agrestis Dougl.	field m.
bisulcatus (Hook.) Gray	twogrooved m.
canadensis L.	Canada m.
ceramicus Sheld. var. filifolius (Gray) Herm.	birdegg m.
cicer L.	cicer m. *
crassicarpus Nutt.	groundplum m.
drummondii Dougl. ex Hook.	Drummond m.
flexuosus (Hook.) D. Don	flexile m.
gilviflorus Sheld.	threeleaf m.
gracilis Nutt.	slender m.
hyalinus M.E. Jones	transparent m.
kentrophyta Gray	kentrophyta m.
lotiflorus Hook.	low m.
missouriensis Nutt.	Missouri m.
mollissimus Torr.	woolly l.
pectinatus (Hook.) G. Don	narrowleaf m.
plattensis Nutt.	Platte m.
racemosus Pursh	creamy m.
sericoleucus Gray	silky m.
shortianus Nutt.	Shorts m.
spatulatus Sheld.	tufted m.
tenellus Pursh	looseflower m.
BAPTISIA Vent.	wildindigo
australis (L.) R. Br. var. minor (Lehm.) Wats.	blue w.
leucantha T. & G.	Atlantic w.
leucophaea Nutt.	plains w.
tinctoria (L.) R. Br.	yellow w.
CAESALPINIA jamesii (T. & G.) Fisher	James rushpea
CARAGANA Lam.	peashrub
arborescens Lam.	Siberian p.
aurantica Koehne.	pygmy p. *
CASSIA L.	partridgepea; senna
fasciculata Michx.	showy p.
marilandica L.	wild s.
CERCIS L.	redbud
canadensis L.	eastern r.
var. alba Rehd.	whitebud
CORONILLA varia L.	crownvetch *
CROTALARIA sagittalis L.	arrow crotalaria

DALEA Willd.	dalea
aurea Nutt.	silktop d.
enneandra Nutt.	slender d.
leporina (Ait.) Bullock	foxtail d.
DESMANTHUS illinoensis (Michx.) MacMill.	Illinois bundleflower
DESMODIUM Desv.	tickclover
canadense (L.) DC.	Canada t.
canescens (L.) DC.	hoary t.
cuspidatum (Muhl.) Loud.	longleaf t.
glutinosum (Muhl.) Wood	largeflower t.
illinoense Gray	Illinois t.
paniculatum (L.) DC.	panicle t.
GLEDITSIA triacanthos L.	honeylocust
GLYCYRRHIZA lepidota Pursh	American licorice
GYMNOCLADUS dioica (L.) Koch	Kentucky coffeetree
LATHYRUS L.	peavine; vetch
ochroleucus Hook.	yellow v.
palustris L.	marsh v.
polymorphus Nutt.	hoary p.
LESPEDEZA Michx.	lespedeza
capitata Michx.	roundhead l.
cuneata (Dumont) G. Don	sericea l. *
stipulacea Maxim.	Korean l. *
striata (Thunb.) H. & A.	common l. *
violacea (L.) Pers.	violet l.
LOTUS L.	deervetch; trefoil
corniculatus L.	birdsfoot t. *
purshianus Clem. & Clem.	American d.
LUPINUS L.	lupine
argenteus Pursh	Nebraska l.
argenteus Pursh var. parviflorus (Nutt.) C. L. Hitchc.	silvery l.
pusillus Pursh	rusty l.
MEDICAGO L.	alfalfa; medic
falcata L.	yellow a. *
lupulina L.	black m. *
sativa L.	alfalfa *
MELILOTUS Mill.	sweetclover
albus Desr.	white s. *
officinalis (L.) Lam.	yellow s. *

ONOBRYCHIS viciaefolia Scop.	sainfoin *
OXYTROPIS L.	locoweed
lambertii Pursh	Lambert l.
multiceps Nutt.	manyhead l.
sericea Nutt.	silky l.
PETALOSTEMON Michx.	prairieclover
arenicola Wemple	sand p.
candidum (Willd.) Michx.	white p.
compactum (Spreng.) Swezey	compact p.
multiflorum Nutt.	roundhead p.
occidentale (Gray) Fern.	western p.
purpureum (Vent.) Rydb.	purple p.
villosum Nutt.	silky p.
PSORALEA L.	scurfpea; breadroot
argophylla Pursh	silverleaf s.
cuspidata Pursh	tallbread s.
digitata Nutt.	finger s.
esculenta Pursh	common b.
hypogaea Nutt.	little b.
lanceolata Pursh	lemon s.
linearifolia T. & G.	narrowleaf s.
tenuiflora Pursh	slimflower s.
tenuiflora Pursh var. floribunda (Nutt.) Rydb.	manyflower s.
ROBINIA pseudoacacia L.	black locust
SCHRANKIA nuttallii (DC.) Standl.	catclaw sensitivebriar
SOPHORA nuttalliana Turner	silky sophora
STROPHOSTYLES Ell.	wildbean
helvola (L.) Ell.	trailing w.
leiosperma (T. & G.) Piper	smoothseed w.
THERMOPSIS rhombifolia Nutt.	prairie goldenpea
TRIFOLIUM L.	clover
campestre Schreb.	plains c. *
fragiferum L.	strawberry c. *
hybridum L.	alsike c. *
incarnatum L.	crimson c. *
pratense L.	red c. *
reflexum L.	buffalo c. *
repens L.	white c. *
stoloniferum Muhl.	running buffalo c. *

VICIA L.	vetch
americana Muhl.	American v.
americana Muhl. var. minor Hook	stiffleaf v.
cracca L.	tufted v. *
dasycarpa Ten.	woollypod v. *
sativa L.	common v. *
villosa Roth	hairy v. *

COMPOSITES
(Including Woody Species)

ACHILLEA millefolium L.	western yarrow
ACTINOMERIS (See Verbesina)	
AGOSERIS glauca (Pursh) Dietr.	false-dandelion
AMBROSIA L.	ragweed; bursage
acanthicarpa Hook. (Franseria acanthicarpa (Hook.) Coville)	annual b.
artemisiifolia L. (A. elatior L.)	common r.
bidentata Michx.	lanceleaf r.
grayi (A.Nels.) Shinners (Franseria tomentosa Gray)	bur r.
psilostachya DC. (A. coronopifolia T. & G.)	western r.
tomentosa Nutt. (Franseria discolor Nutt.)	skeletonleaf b.
trifida L.	giant r.
ANAPHALIS margaritacea (L.) Benth. & Hook.	pearly-everlasting
ANTENNARIA Gaertn.	pussytoes
neglecta Greene	field p.
parvifolia Nutt. (A.aprica Greene)	Rocky Mountain p.
plantaginifolia (L.) Richards	plantainleaf p.
rosea Greene	rose p.
ANTHEMIS cotula L.	mayweed *
ARCTIUM minus Schk.	common burdock *
ARTEMISIA L.	sagebrush; sagewort; wormwood
absinthium L.	wormwood *
biennis Willd.	biennial sw.
campestris L.	prairie sw.
cana Pursh	silver s.

dracunculus L.	linearleaf w.
filifolia Torr.	sand s.
frigida Willd.	fringed sw.
ludoviciana Nutt.	cudweed sw.
var. mexicana (Willd.) Fern.	
tridentata Nutt.	big s.
ASTER L.	aster
azureus Lindl.	azure a.
brachyactis Blake	rayless a.
drummondii Lindl.	Drummond a.
ericoides L.	heath a.
falcatus Lindl.	white prairie a.
fendleri Gray	Fendler a.
hesperis Gray	panicle a.
junciformis Rydb.	rush a.
laevis L.	blue a.
lateriflorus (L.) Britt.	lateral-flowered a.
novae-angliae L.	New England a.
oblongifolius Nutt.	aromatic a.
ontarionis Wieg.	Ontario a.
pansus (Blake) Cronq.	pansy a.
pilosus Willd.	pilose a.
praealtus Poir.	willowleaf a.
pubentior Cronq.	pubescent a.
puniceus L.	swamp a.
sagittifolius Willd.	arrowleaf a.
sericeus Vent.	silky a.
simplex Willd.	panicle a.
subulatus Michx. var. ligulatus Shinners	subulate a.
BAHIA (See Picradeniopsis)	
BIDENS L.	beggarticks
bipinnata L.	spanishneedles
cernua L.	nodding b.
comosa (Gray) Wieg.	leafy b.
connata Muhl.	sticktight b.
coronata (L.) Britt.	crown b.
frondosa L.	devils b.
polylepis Blake	coreopsis b.
vulgata Greene	tall b.
BOLTONIA asteroides (L.) L'Her.	white boltonia
var. latisquama (Gray) Cronq.	violet b.
BRICKELLIA grandiflora (Hook.) Nutt.	tasselflower brickellia
CACALIA L.	indianplantain
atriplicifolia L.	pale i.
tuberosa Nutt.	tuberous i.

CARDUUS L.	thistle
acanthoides L.	plumeless t. *
nutans L.	musk t. *
CENTAUREA L.	centaurea
americana Nutt.	basketflower
cyanus L.	cornflower *
repens L.	Russian knapweed *
solstitialis L.	yellow starthistle *
CHRYSANTHEMUM leucanthemum L.	oxeyedaisy *
CHRYSOPSIS Ell.	goldaster
horrida Rydb.	horrid g.
stenophylla (Gray) Greene	narrowleaf g.
villosa (Pursh) Nutt.	hairy g.
CHRYSOTHAMNUS nauseosus (Pall.) Britt.	rubber rabbitbrush
CICHORIUM intybus L.	chicory *
CIRSIUM Mill.	thistle
altissimum (L.) Spreng.	tall t.
arvense (L.) Scop.	Canada t. *
canescens Nutt.	Platte t.
discolor (Muhl.) Spreng.	field t.
flodmanii (Rydb.) Arthur	Flodman t.
ochrocentrum Gray	yellowspine t.
undulatum (Nutt.) Spreng.	wavyleaf t.
vulgare (Savi) Tenore	bull t. *
CONYZA L.	conyza
canadensis (L.) Cronq. (Erigeron)	horseweed
ramosissima Cronq. (E. divaricatus Michx.)	dwarf c.
COREOPSIS L.	coreopsis
palmata Nutt.	finger c.
tinctoria Nutt.	plains c.
CREPIS L.	hawksbeard
acuminata Nutt.	acuminate h.
occidentalis Nutt.	western h.
runcinata (James) T. & G.	dandelion h.
DYSSODIA papposa (Vent.) Hitchc.	fetid marigold
ECHINACEA Moench	echinacea
angustifolia DC.	blacksamson e.
pallida Nutt.	pale e.

ECLIPTA alba (L.) Hassk.	yerba-de-tago *
ERECHTITES hieracifolia (L.) Raf.	American burnweed
ERIGERON L. (Also see Conyza)	fleabane
annuus (L.) Pers.	annual f.
bellidiastrum Nutt.	western daisy f.
caespitosus Nutt.	cespitose f.
canus Gray	hoary f.
divergens T. & G.	spreading f.
flagellaris Gray	running f.
glabellus Nutt.	smooth f.
philadelphicus L.	Philadelphia f.
pumilus Nutt.	lower f.
strigosus Muhl.	daisy f.
subtrinervis Rydb.	false three-nerved f.
EUPATORIUM L.	joepyeweed
altissimum L.	tall j.
maculatum L.	spotted j.
var. bruneri (Gray) Breitung	Bruner j.
perfoliatum L.	boneset
purpureum L.	sweet j.
rugosum Houtt.	white snakeroot
serotinum Michx.	late eupatorium
FRANSERIA (See Ambrosia)	
GAILLARDIA pulchella Foug.	rosering gaillardia
GALINSOGA ciliata (Raf.) Blake	fringed quickweed *
GNAPHALIUM L.	cudweed
obtusifolium L.	fragrant c.
palustre Nutt.	mouse-ear c.
GRINDELIA squarrosa (Pursh) Dunal	curlycup gumweed
GUTIERREZIA sarothrae (Pursh) Britt. & Rusby	broom snakeweed
HAPLOPAPPUS Endl.	goldenweed
annuus (Rydb.) Cory	annual g.
armerioides (Nutt.) Gray	stenotus
ciliatus (Nutt.) DC.	ovalleaf g.
spinulosus (Pursh) DC.	ironplant
HELENIUM L.	bitterweed; sneezeweed
amarum (Raf.) Rock	bitterweed
autumnale L.	sneezeweed

HELIANTHUS L.	sunflower
annuus L.	common s.
ciliaris DC.	Texas blueweed
grosseserratus Martens	sawtooth s.
hirsutus Raf.	stiffhair s.
maximiliani Schrad.	Maximilian s.
mollis Lam.	ashy s.
nuttallii T. & G.	Nuttalls s.
petiolaris Nutt.	prairie s.
rigidus (Cass.) Desf. (H. laetiflorus Pers.)	stiff s.
tuberosus L. (H. mollissimus E. E. Wats.)	Jerusalem-artichoke
HELIOPSIS helianthoides (L.) Sweet var. scabra (Dunal) Fern.	rough heliopsis
HIERACIUM (Tourn.) L.	hawkweed
canadense Michx.	Canada h.
longipilum Torr.	longbeard h.
HYMENOPAPPUS L'Her.	hymenopappus
filifolius Hook.	fineleaf h.
scabiosaeus Litter.	old-plainsman
tenuifolius Pursh	woollywhite h.
HYMENOXYS Cass.	hymenoxys
acaulis (Pursh) Parker	stemless h.
scaposa (DC.) Parker	scapose h.
IVA L.	marshelder
annua L.	rough sumpweed
axillaris Pursh	povertyweed
xanthifolia Nutt.	burweed m.
KRIGIA oppositifolia Raf.	common dwarf-dandelion
KUHNIA eupatorioides L. var. corymbulosa T. & G.	false boneset
LACTUCA L.	lettuce
canadensis L.	Canada l.
floridana (L.) Gaertn.	Florida l.
ludoviciana (Nutt.) Riddell	western l.
oblongifolia Nutt.	blue l.
saligna L.	willow leaf l. *
serriola L.	prickly l. *
LEUCELENE ericoides (Torr.) Greene	white aster

LIATRIS Schreb.	gayfeather
aspera Michx.	rough g.
glabrata Rydb.	scaly g.
lancifolia (Greene) Kittell	lanceleaf g.
mucronata DC.	pointed g.
punctata Hook.	dotted g.
pycnostachya Michx.	thickspike g.
LYGODESMIA D. Don	skeletonplant
juncea (Pursh) D. Don	rush s.
rostrata Gray	beaked s.
MACHAERANTHERA Nees.	goldenweed
canescens (Pursh) Gray	hoary g.
grindelioides (Nutt.) Shinners	rayless g.
linearis Greene	linear g.
tanacetifolia (H.B.K.) Nees	tansy aster
MATRICARIA L.	wild chamomile
maritima L.	wild c. *
matricarioides (Less.) Porter	pineappleweed *
MICROSERIS cuspidata (Pursh) Schultz-Bip.	waveyleaf agoseris
PALAFOXIA sphacelata (Nutt.) Cory	othake
PECTIS angustifolius Torr.	lemonscent pectis
PICRADENIOPSIS Rydb.	bahia
oppositifolia (Nutt.) Rydb.	plains b.
woodhousii (Gray) Rydb.	wodehouse b.
PRENANTHES L.	rattlesnake-root
aspera Michx.	rough r.
racemosa Michx.	branched r.
PYRRHOPAPPUS carolinianus (Walt.) DC.	falsedandelion
RATIBIDA Raf.	prairieconeflower
columnifera (Nutt.) Woot. & Standl.	upright p.
pinnata (Vent.) Barnh.	grayhead p.
tagetes (James) Barnh.	shortray p.
RUDBECKIA L.	coneflower
hirta L.	black-eyedsusan
laciniata L.	cutleaf c.
subtomentosa Pursh.	sweet c.
triloba L.	brown-eyedsusan
SENECIO L.	groundsel
canus Hook.	silvery g.
glabellus Poir.	butterweed

integerrimus Nutt.	lambstongue g.
plattensis Nutt.	prairie g.
pseudaureus Rydb.	golden g.
var. semicordatus (Mack. & Bush) T.M. Barkley	
riddellii T. & G.	Riddell g.
spartioides T. & G.	broom g.
tridenticulatus Rydb.	squawweed
SILPHIUM L.	rosinweed
integrifolium Michx.	wholeleaf r.
laciniatum L.	compassplant
perfoliatum L.	cup r.
SOLIDAGO L.	goldenrod
canadensis L.	Canada g.
var. scabra (Muhl.) T. & G.	
flexicaulis L.	broadleaf g.
gigantea Ait.	giant g.
*var. serotina (Kuntze) Cron.	late g.
graminifolia (L.) Salisb.	grassleaf g.
missouriensis Nutt.	Missouri g.
mollis Bartl.	ashy g.
nemoralis Ait.	gray g.
petiolaris Ait.	downy g.
rigida L.	stiff g.
speciosa Nutt.	showywand g.
ulmifolia Muhl.	elmleaf g.
SONCHUS L.	sowthistle
asper (L.) Hill	prickly s. *
oleraceus L.	common s. *
uliginosus Bieb.	uliginose s. *
TANACETUM vulgare L.	common tansy
TARAXACUM Wiggers	dandelion
laevigatum (Willd.) DC.	smooth d. *
officinale Weber	common d. *
THELESPERMA Less.	greenthread
filifolium (Hook.) Gray	narrowleaf g.
megapotamicum (Spreng.) Kuntze	slender g.
TOWNSENDIA Hook.	townsendia
exscapa (Rich.) Porter	easter-daisy
grandiflora Nutt.	largeflower t.
hookeri Beaman	Hookers t.

*Nebraska State Flower

TRAGOPOGON L.	salsify
dubius Scop.	western s. *
porrifolius L.	common s. *
VERBESINA L.	crownbeard
alternifolia (L.) Britt.	wingstem
encelioides (Cav.) B. & H.	golden c.
virginica L.	frostweed
VERNONIA Schreb.	ironweed
baldwini Torr. var. interior (Small) Schub.	inland i.
fasciculata Michx.	western i.
gigantea (Walt.) Trel.	giant i.
missourica Raf.	Missouri i.
XANTHIUM strumarium L.	cocklebur

OTHER DICOT FORBS
(Except Legumes and Composites)

ABRONIA fragrans Nutt. ex Hook.	sweet sandverbena
ABUTILON theophrasti Medic.	velvetleaf *
ACALYPHA L.	copperleaf; mercury
rhomboidea Raf.	rhombic c.
virginica L.	threeseeded m.
ACERATES (See ASCLEPIAS)	
AEGOPODIUM podagraria L.	bishops goutweed
AGALINIS Raf.	agalinis
aspera (Benth.) Britt.	rough a.
purpurea (L.) Penn.	purple a.
tenuifolia (Vahl.) Raf.	slender a.
AGASTACHE Clayt.	gianthyssop
nepetoides (L.) Kuntze	catnip g.
scrophulariaefolia (Willd.) Kuntze	purple g.
AGRIMONIA L.	agrimony
gryposepala Wallr.	hooksepaled a.
parviflora Ait.	manyflower a.
pubescens Wallr.	downy a.
striata Michx.	grooved a.
AGROSTEMMA githago L.	corncockle

AJUGA reptans L.	carpet bugleweed *
ALTHAEA rosea (L.) Cav.	hollyhock *
ALYSSUM alyssoides L.	alyssum *
AMARANTHUS L.	pigweed; waterhemp; amaranthus
albus L.	tumbleweed a.
arenicola Johnst.	sand a.
graecizans L.	tumbleweed a.
hybridus L.	slender p. *
palmeri Wats.	Palmers p.
retroflexus L.	rough p. *
rudis Sauer	waterhemp
spinosus L.	spiny p.
tuberculatus (Moq.) Sauer	tall w.
AMPELAMUS (See Cynanchum)	
ANCHUSA azurea Mill.	Italian alkanet
ANDROSACE occidentalis Pursh	western rockjasmine
ANEMONE L.	anemone
canadensis L.	meadow a.
caroliniana Walt.	Carolina a.
cylindrica Gray	candle a.
multifida Poir.	cutleaf a.
pulsatilla L.	pasqueflower
virginiana L.	tall a.
ANETHUM graveolens L.	dill *
APOCYNUM L.	dogbane
androsaemilfolium L.	spreading d.
cannabinum L.	hemp d.
sibiricum Jacq.	prairie d.
AQUILEGIA canadensis L.	wild columbine
ARABIS L.	rockcress
canadensis L.	sicklepod
glabra (L.) Bernh.	tower mustard
hirsuta (L.) Scop. var. pycnocarpa (Hopkins) Roll.	hairy r.
holboelii Hornem. var. pinetorum (Tidest.) Roll.	Holboell r.
shortii (Fern.) Gl.	Shorts r.
ARALIA racemosa L.	American spikenard

ARENARIA L.	sandwort
hookeri Nutt.	Hookers s.
lateriflora L.	grove s.
serpylliflora L.	thyme-leaf s.
stricta Michx. ssp. texana (Robins.) Maguire	rock s.
ARGEMONE polyanthemos (Fedde) G. Ownbey	pricklypoppy
ARMORACIA rusticana Gaertn., Mey., & Schreb.	horseradish *
ASCLEPIAS L.	milkweed
amplexicaulis Sm.	bluntleaf m.
arenaria Torr.	sand m.
engelmanniana Woods.	Engelmanns m.
incarnata L.	swamp m.
lanuginosa Nutt.	woolly m.
latifolia (Torr.) Raf.	broadleaf m.
pumila (Gray) Vail	dwarf m.
speciosa Torr.	showy m.
stenophylla Gray	narrowleaf m.
sullivantii Engelm.	smooth m.
syriaca L.	common m.
tuberosa L. ssp. interior Woods.	butterfly m.
verticillata L.	whorled m.
viridiflora Raf.	green m.
viridis Walt.	green antelopehorn
ATRIPLEX L.	saltbush; orach
argentea Nutt.	silverscale s.
hortensis L.	garden o.
nuttallii Wats.	Gardner s.
patula L.	spearscale o.
rosea L.	redscale o. *
BACOPA rotundifolia (Michx.) Wettst.	waterhyssop
BARBAREA vulgaris R. Br.	wintercress *
BERTEROA incana (L.) DC.	hoary falsealyssum *
BERULA erecta (Huds.) Cov. var. incisum (Torr.) Cronq.	water-parsnip
BESSEYA wyomingensis (A. Nels.) Rydb.	kittentails
BETA vulgaris L.	beet *

BLEPHILIA hirsuta (Pursh) Benth.	woodmint
BOEHMERIA cylindrica (L.) Sw.	boghemp
BRASSICA L.	mustard
campestris L.	wild turnip *
hirta Moench	white m. *
juncea (L.) Coss.	India m. *
kaber (DC.) Wheeler	charlock *
nigra (L.) Koch	black m. *
oleracea L.	cabbage *
rapa L.	turnip *
CALLIRHOE Nutt.	poppymallow
alcaeoides (Michx.) Gray	pink p.
involucrata (T. & G.) Gray	purple p.
CALLITRICHE verna L.	water-starwort
CALTHA palustris L.	marsh-marigold
CALYLOPHUS Spach	evening-primrose
hartwegii (Benth.) Raven ssp. lavandulifolius (T. & G.) Towner & Raven	Hartwegs e.
serrulatus (Nutt.) Raven	yellow e.
CAMELINA Crantz	falseflax
microcarpa Andrz.	little f. *
sativa (L.) Crantz	gold-of-pleasure *
CAMPANULA L.	bellflower
americana L.	tall b.
aparinoides Pursh	marsh b.
persicifolia L.	peachleaf b. *
rapunculoides L.	creeping b. *
rotundifolia L.	harebell
CANNABIS sativa L.	hemp *
CAPSELLA bursa-pastoris (L.) Medic.	shepherdspurse
CARDAMINE L.	bittercress
bulbosa (Schreb.) BSP	springcress
pensylvanica Muhl.	bittercress
CARDARIA draba (L.) Desv.	hoary cress *
CASTILLEJA sessiliflora Pursh	downy paintbrush
CAULOPHYLLUM thalictroides (L.) Michx.	blue cohosh

CENTHRANTHUS ruber (L.) DC.	jupitersbeard
CENTUNCULUS minimus L.	chaffweed
CERASTIUM L.	cerastium
arvense L.	prairie c.
brachypodum (Engelm.) Robins.	shortstalk c.
glomeratum Thuill.	sticky c. *
nutans Raf.	powderhorn c.
vulgatum L.	mouse-ear c. *
CERATOPHYLLUM demersum L.	common coontail
CHAEROPHYLLUM procumbens (L.) Crantz	chervil
CHENOPODIUM L.	goosefoot
album L.	lambsquarters *
ambrosioides L.	Mexican tea *
berlandieri Moq.	pitseed g.
desiccatum A. Nels.	driedup g.
fremontii Wats.	Fremonts g.
glaucum L.	oakleaf g. *
hybridum L.	maple leaf g.
incanum (S. Wats.) Heller	hoary g.
missouriense Aellen	Missouri g.
rubrum L.	alkaliblite
standleyanum Aellen	Standley g.
strictum Roth	erect g.
CHORISPORA tenella (Pall.) DC.	blue-mustard *
CICUTA L.	waterhemlock
bulbifera L.	bulbous w.
maculata L.	waterhemlock
CIRCAEA lutetiana L. ssp. canadensis (L.) Asch. & Magnus	enchanters-nightshade
CLAYTONIA virginica L.	Virginia springbeauty
CLEMATIS L.	clematis
fremontii Wats.	Fremonts c.
ligusticifolia Nutt.	western c.
pitcheri T. & G.	Pitchers c.
virginiana L.	virginsbower
CLEOME serrulata Pursh	Rocky Mountain beeplant
CLEOMELLA angustifolia Torr.	cleomella
COLLOMIA linearis Nutt.	collomia

COMANDRA umbellata (L.) Nutt.	bastard-toadflax
CONIUM maculatum L.	poisonhemlock *
CONRINGIA orientalis (L.) Dum.	haresear *
CONVOLVULUS L.	bindweed
arvensis L.	field b. *
sepium L.	hedge b. *
CORISPERMUM hyssopifolium L.	bugseed *
CORYDALIS Medic.	corydalis
aurea Willd.	golden c.
aurea Willd. var. occidentalis Engelm.	western c.
micrantha (Engelm.) Gray	slender fumewort
CORYPHANTHA (Engelm.) Lem.	pincushion
missouriensis (Sweet) Britt. & Rose	Missouri p.
vivipara (Nutt.) Britt. & Rose	sprouting p.
CRISTATELLA jamesii T. & G.	cristatella
CROTON L.	croton
capitatus Michx.	woolly c.
glandulosus L. var. septentrionalis Muell. Arg.	tropic c.
monanthogynus Michx.	oneseeded c.
texenis (Klotzsch) Muell. Arg.	Texas c.
CRYPTANTHA Lehm.	cryptantha
cana (A. Nels.) Pays.	hoary c.
celosioides (Eastw.) Pays.	cockscomb c.
fendleri (Gray) Greene	Fendler c.
jamesii (Torr.) Pays.	James c.
minima Rydb.	least c.
thyrsiflora (Greene) Pays.	western c.
CRYPTOTAENIA canadensis (L.) DC.	honewort
CUCURBITA foetidissima HBK	buffalogourd
CUPHEA viscosissima Jacq.	blue waxweed
CUSCUTA L.	dodder
cephalanthi Engelm.	buttonbush d.
compacta Juss.	dense d.
coryli Engelm.	hazel d.
cuspidata Engelm.	cusp d.
glomerata Choisy	cluster d.
gronovii Willd.	Gronovius d.

indecora Choisy	largealfalfa d.
pentagona Engelm.	field d.
polygonorum Engelm.	smartweed d.
umbrosa Hook.	shadeloving d.
CYCLOLOMA atriplicifolium (Spreng.) Coult.	winged-pigweed
CYMOPTERUS Raf.	wild parsley
acaulis (Pursh) Raf.	wild parsley
montanus Nutt.	mountain corkwing
CYNANCHUM laeve (Michx.) Pers.	sandvine
CYNOGLOSSUM officinale L.	houndstongue *
DATURA stramonium L.	jimsonweed *
DAUCUS carota L.	wild carrot *
DELPHINIUM L.	larkspur
ajacis L.	rocket l. *
nuttallianum Pritz. ex Walp.	blue l.
tricorne Michx.	dwarf l.
virescens Nutt.	prairie l.
DENTARIA laciniata Muhl.	toothwort
DESCURAINIA Webb & Berth.	tansymustard
pinnata (Walt.) Britt. var. brachycarpa (Richards.) Fern.	pinnate t.
sophia (L.) Webb.	flixweed t.
DIANTHUS L.	pink
armeria L.	Deptford p.
plumarius L.	cottage p.
DICENTRA cucullaria (L.) Bernh.	dutchmans-breeches
DODECATHEON pauciflorum (Durand) Greene	shootingstar
DRABA L.	whitlow-wort
nemorosa L.	yellow w.
reptans (Lam.) Fern.	white w.
DRACOCEPHALUM parviflorum Nutt.	dragonhead
ECHINOCEREUS viridiflorus Engelm.	hedgehog-cactus
ECHINOCYSTIS lobata (Michx.) T. & G.	wild-cucumber
ECHIUM vulgare L.	blueweed *

ELATINE triandra Schk.	waterwort
ELLISIA nyctelea L.	waterpod
EPILOBIUM L.	willowherb
adenocaulon Haussk.	glandularstem w.
coloratum Biehler	purpleleaf w.
leptophyllum Raf.	narrowleaf w.
ERIOGONUM Michx.	eriogonum
alatum Torr.	winged e.
annuum Nutt.	annual e.
cernuum Nutt.	nodding e.
effusum Nutt.	spreading e.
flavum Nutt.	yellow e.
pauciflorum Pursh var. gnaphaloides (Benth.) Reveal	everlasting e.
pauciflorum Pursh var. pauciflorum	few-flowered e.
ERODIUM cicutarium (L.) L'Her.	filaree *
ERYSIMUM L.	wallflower
asperum (Nutt.) DC.	western w.
cheiranthoides L.	wormweed w.
inconspicuum (Wats.) MacM.	smallflower w.
repandum L.	bushy w. *
EUPHORBIA L.	spurge
cyathophora Murr.	fire-on-the-mountain
cyparissias L.	cypress s.
dentata Michx.	toothed s.
fendleri T. & G.	Fendlers s.
geyeri Engelm.	Geyers s.
glyptosperma Engelm.	ridgeseed s.
hexagona Nutt.	sixangled s.
maculata L.	spotted s.
marginata Pursh	snow-on-the-mountain
missurica Raf.	Missouri s.
nutans Lag.	nodding s.
podperae Croizat	leafy s. *
prostrata Ait.	prostrate s.
robusta (Engelm.) Small	robust s.
serpens HBK	roundleaf s.
serpyllifolia Pers.	thymeleaf s.
spathulata Lam.	spathulate s.
strictospora Engelm.	mat s.
EUSTOMA grandiflorum (Raf.) Shinners	prairiegentian
EVOLVULUS nuttallianus R. & S.	Nuttall evolvulus

FAGOPYRUM esculentum Moench	buckwheat
FRAGARIA L.	strawberry
vesca L. var. americana Porter	wood s.
virginiana Duchn.	wild s.
FROELICHIA Moench	snakecotton
floridana (Nutt.) Moq. var. campestris (Small) Fern.	field s.
gracilis (Hook.) Moq.	slender s.
GALIUM L.	bedstraw
aparine L.	catchweed b.
boreale L.	northern b.
circaezans Michx.	woods b.
concinnum T. & G.	shining b.
obtusum Bigel.	bluntleaf b.
trifidum L.	small b.
GAURA L.	gaura
coccinea Pursh	scarlet g.
longiflora Spach	long-flowered g.
parviflora Dougl.	velvety g.
GENTIANA L.	gentian
andrewsii Griseb.	Andrews g.
puberulenta Pringle	downy g.
GERANIUM L.	geranium
carolinianum L.	Carolina g.
himalayense Klotzsch	lilac g.
maculatum L.	wild g.
pusillum L.	small g. *
GERARDIA (See AGALINUS)	
GEUM L.	avens
alleppicum Jacq. var. strictum (Ait.) Fern.	yellow a.
canadense Jacq.	white a.
GILIA spicata Nutt.	spike gilia
GLECOMA hederacea L.	groundivy *
GRATIOLA virginiana L.	Virginia hedgehyssop
GYPSOPHILA paniculata L.	perennial babysbreath *
HACKELIA Opiz	stickseed
deflexa (Wahl.) Opiz	American s.

floribunda (Lehm.) Johnst.	manyflower s.
virginiana (L.) Johnst.	Virginia s.
HEDEOMA Pers.	pennyroyal
drummondii Benth.	Drummond false p.
hispida Pursh	rough p.
pulegioides (L.) Pers.	American p.
HEDYOTIS nigricans (Lam.) Fosb.	narrowleaf bluets
HELIANTHEMUM bicknellii Fern.	frostweed
HELIOTROPIUM curassavicum L.	seaside heliotrope *
HERACLEUM sphondylium L.	cowparsnip
HESPERIS matronalis L.	dames rocket *
HEUCHERA L.	alumroot
hirsuticaulis (Wheel.) Rydb.	hairystem a.
richardsonii R. Br.	Richardsons a.
HIBISCUS L.	rosemallow
militaris Cav.	scarlet r.
trionum L.	flower-of-an-hour *
HOLOSTEUM umbellatum L.	jagged chickweed
HOUSTONIA (See HEDYOTIS)	
HUMULUS L.	hop
lupulus L.	hop
japonicus Sieb. & Zucc.	Japanese h. *
HYDROPHYLLUM L.	waterleaf
appendiculatum Michx.	notchbract w.
virginianum L.	Virginia w.
HYPERICUM L.	St. johnswort
canadense L.	Canada S.
majus (Gray) Britt.	greater S.
perforatum L.	common S. *
sphaerocarpum Michx.	roundfruit S.
IMPATIENS L.	touch-me-not
biflora Walt.	spotted t.
pallida Nutt.	pale t.
IPOMOEA L.	morningglory
hederacea (L.) Jacq.	ivyleaf m. *
leptophylla Torr.	bush m.
purpurea (L.) Roth	common m. *

IPOMOPSIS Michx.	gilia
congesta (Hook.) V. Grant	ballhead g.
longiflora (Torr.) V. Grant	whiteflower g.
ISANTHUS brachiatus (L.) BSP	false-pennyroyal
KOCHIA scoparia (L.) Schrader	kochia *
LAMIUM L.	deadnettle
amplexicaule L.	henbit *
purpureum L.	purple d. *
LAPORTEA canadensis (L.) Wedd.	woodnettle
LAPPULA Moench	stickseed
echinata Gilib.	blue s. *
redowskii (Hornem.) Greene	low s. *
texana (Scheele) Britt.	cupseed s.
LECHEA L.	pinweed
mucronata Raf.	mucronate p.
stricta Leggett	erect p.
LEONURUS L.	motherwort
cardiaca L.	common m. *
marrubiastrum L.	horehound m. *
LEPIDIUM L.	pepperweed
campestre (L.) R. Br.	field p. *
densiflorum Schrader	densely-flowered p.
oblongum Small	oblong p.
perfoliatum L.	clasping p. *
virginicum L.	Virginia p.
LESQUERELLA S. Wats.	bladderpod
alpina (Nutt.) S. Wats.	alpine b.
arenosa (Richards.) Rydb. var. arenosa	sand b.
arenosa (Richards.) Rydb. var. argillosa Roll. & Shaw	clay b.
ludoviciana (Nutt.) S. Wats.	Louisiana b.
ovalifolia Rydb.	ovalleaf b.
LIMOSELLA aquatica L.	mudwort
LINARIA Mill.	toadflax
canadensis (L.) Dumont var. texana (Scheele) Penn.	oldfield t.
dalmatica (L.) Mill.	toadflax *
vulgaris Hill	butter-and-eggs *

LINDERNIA All.	false-pimpernel
anagallidea (Michx.) Penn.	false-pimpernel
dubia (L.) Penn.	false-pimpernel
LINUM L.	flax
perenne L. var. lewisii (Pursh)	blue f.
rigidum Pursh var. compactum (A. Nels.) Rogers	stiffstem f.
rigidum Pursh var. rigidum	stiffstem f.
sulcatum Riddell	grooved f.
usitatissimum L.	common f. *
LITHOSPERMUM L.	gromwell
arvense L.	corn g. *
canescens (Michx.) Lehm.	hoary g.
caroliniense (Walt.) MacM.	Carolina g.
incisum Lehm.	cleft g.
LOBELIA L.	lobelia
cardinalis L.	cardinalflower
siphilitica L.	bigblue l.
spicata Lam.	palespike l.
LOMATIUM Raf.	lomatium
foeniculaceum (Nutt.) Coult. & Rose var. daucifolium (T. & G.) Cronq.	carrotleaf l.
orientale Coult. & Rose	eastern l.
LUDWIGIA L.	seedbox
palustris (L.) Ell.	water purslane
polycarpa Short & Peter	manyseed s.
LYCHNIS L.	campion
alba Mill.	whitecockle *
chalcedonica L.	Maltesecross
drummondii (Hook) S. Wats.	Drummonds c.
LYCOPERSICUM esculentum Mill.	tomato *
LYCOPUS L.	bugleweed
americanus Muhl.	American b.
asper Greene	rough b.
uniflorus Michx.	oneflower b.
virginicus L.	Virginia b.
LYSIMACHIA L.	loosestrife
ciliata L.	fringed l.
hybrida Michx.	hybrid l.
thyrsiflora L.	tufted l.

LYTHRUM L.	lythrum
dacotanum Nieuw.	lythrum
salicaria L.	purple l.
MALVA L.	mallow
neglecta Wallr.	common m. *
parviflora L.	smallfruit m. *
rotundifolia L.	running m. *
sylvestris L.	high m. *
verticillata L.	cluster m.
MAMMILLARIA (See CORYPHANTHA)	
MARRUBIUM vulgare L.	common horehound *
MARTYNIA (See PROBOSCIDEA)	
MENISPERMUM canadense L.	moonseed
MENTHA L.	mint
arvensis L.	field m. *
piperita L.	peppermint
spicata L.	spearmint *
MENTZELIA L.	mentzelia
decapetala (Pursh) Urban & Gilg	tenpetal m.
nuda (Pursh) T. & G.	bractless m.
oligosperma Nutt.	stickleaf m.
MICROSTERIS gracilis (Hook.) Greene var. humilior (Hook.) Cronq.	slender-phlox
MIMULUS L.	monkeyflower
alatus Ait.	sharpwing m.
glabratus H.B.K. var. fremontii (Benth.) Grant	roundleaf m.
ringens L.	Alleghany m.
MIRABILIS L.	four-o'clock
albida (Walt.) Heimerl	white f.
glabra (S. Wats.) Standl.	smooth f.
hirsuta (Pursh) MacM.	hairy f.
linearis (Pursh) Heimerl	narrowleaf f.
nyctaginea (Michx.) MacM.	prairie f.
MOLLUGO verticillata L.	carpetweed *
MONARDA L.	beebalm
fistulosa L. var. fistulosa	wild bergamot
fistulosa L. var. menthaefolia (Graham) Fern.	mintleaf bergamot
pectinata Nutt.	spotted b.

MONOLEPIS nuttalliana (Schult.) Greene	povertyweed
MONOTROPA uniflora L.	indianpipe
MUSINEON	musineon
divaricatum (Pursh) Nutt. ex T. & G.	spreading m.
tenuifolium Nutt.	slenderleaf m.
MYOSURUS minimus L.	mousetail
MYRIOPHYLLUM L.	milfoil
pinnatum (Walt.) BSP	green m.
spicatum L. var. exalbescens (Fern.) Jeps.	spike m.
NASTURTIUM officinale R. Br.	nasturtium
NELUMBO lutea (Willd.) Pers.	yellow nelumbo
NEPETA cataria L.	catnip *
NICANDRA physalodes (L.) Gaertn.	nicandra *
NUPHAR luteum (L.) Sibth. & Sm.	yellow cowlily
NYMPHAEA L.	waterlily
odorata Ait.	American w.
tuberosa Paine	white w.
OENOTHERA L.	eveningprimrose
albicaulis Pursh	pale e.
biennis L.	common e.
caespitosa Nutt.	gumbo lily
canescens Torr. & Frem.	beakpod e.
coronopifolia T. & G.	combleaf e.
fremontii S. Wats.	Fremonts e.
laciniata Hill	cutleaf e.
macrocarpa Nutt.	Missouri e.
nuttallii Sweet	white-stemmed e.
rhombipetala Nutt.	fourpoint e.
speciosa Nutt.	white e.
strigosa (Rydb.) Mack. & Bush	common e.
ONOPORDUM acanthium L.	Scotch thistle *
ONOSMODIUM Michx.	false-gromwell
molle Michx. var. hispidissimum (Mack.) Cronq.	false-gromwell
molle Michx. var. occidentale (Mack.) Johnst.	western marbleseed

OPUNTIA Mill.	pricklypear
fragilis (Nutt.) Haw.	brittle p.
macrorhiza Engelm.	bigroot p.
polyacantha Haw.	plains p.
OROBANCHE	broomrape
fasciculata Nutt.	bunched b.
ludoviciana Nutt.	Louisiana b.
uniflora L.	oneflower b.
ORTHOCARPUS luteus Nutt.	yellow owlclover
OSMORHIZA Raf.	sweetcicely
claytonii (Michx.) Clarke	sweetjarvil
longistylis (Torr.) DC. var. longistylis	sweetcicely
longistylis (Torr.) DC. var. villicaulis	sweetcicely
OXALIS L.	woodsorrel
dillenii Jacq.	dillen yellow w.
stricta L.	common yellow w.
violacea L.	violet w.
OXYBAPHUS (See MIRABILIS)	
PANAX quinquefolium L.	American ginseng
PAPAVER orientale L.	oriental poppy
PARIETARIA pensylvanica Muhl.	Pennsylvania pellitory
PARONYCHIA Mill.	nailwort
canadensis (L.) Wood	forked chickweed
depressa Nutt.	flattened n.
jamesii T. & G.	James n.
sessiliflora Nutt.	whitlowwort
PASTINACA sativa L.	parsnip *
PEDICULARIS L.	lousewort
canadensis L.	early l.
lanceolata Michx.	swamp l.
PENSTEMON Mitchell	penstemon
albidus Nutt.	white p.
angustifolius Nutt.	narrow p.
cobaea Nutt.	cobaea p.
digitalis Nutt.	smooth p.
eriantherus Pursh	crested p.
glaber Pursh	sawsepal p.

gracilis Nutt.	slender p.
grandiflorus Nutt.	shell-leaf p.
haydeni S. Wats.	Hayden p.
tubaeflorus Nutt.	tube p.
PENTHORUM sedoides L.	ditch-stonecrop
PHACELIA hastata Dougl. ex Lehm. var. leucophylla (Torr.) Cronq.	scorpionweed
PHLOX L.	phlox
andicola Nutt.	moss p.
divaricata L.	sweet-william p.
hoodii Rich.	Hoods p.
paniculata L.	fall p. *
pilosa L.	prairie p.
subulata L.	moss p.
PHRYMA leptostachya L.	lopseed
PHYLA Lour.	fogfruit
cuneifolia (Torr.) Greene	western f.
lanceolata (Michx.) Greene	common f.
PHYSALIS L.	groundcherry
hederaefolia Gray var. comata (Rydb.) Waterfall	roundleaf g.
heterophylla Nees	clammy g.
pubescens L.	downy g.
pumila Nutt.	prairie g.
virginiana Mill. var. hispida Waterfall	lanceleaf g.
virginiana Mill. var. sonorae (Torr.) Waterfall	spearleaf g.
virginiana Mill. var. subglabrata (Mack. & Bush) Waterfall	taperleaf g.
virginiana Mill. var. virginiana Waterfall	paleseed g.
PHYSOSTEGIA virginiana (L.) Benth.	false-dragonhead
PHYTOLACCA americana L.	pokeberry
PILEA pumila (L.) Gray	clearweed
PLANTAGO L.	plantain
aristata Michx.	bracted p.
elongata Pursh	elongate p.
eriopoda Torr.	alkali p.
lanceolata L.	English p. *
major L.	common p. *

patagonica Jacq.	woolly p.
patagonica Jacq. var. spinulosa (Decne.) Gray	spiny p.
rugelii Decne.	blackseed p.
virginica L.	paleseed p.
PODOPHYLLUM peltatum L.	mayapple
POLANISIA dodecandra (L.) DC.	clammyweed
POLYGALA L.	polygala; milkwort
alba Nutt.	white m.
sanguinea L.	blood p.
verticillata L.	whorled m.
POLYGONUM L.	knotweed; smartweed
achoreum Blake	erect k.
amphibium L.	water s.
arenastrum Jord. ex Bor.	common k. *
bicorne Raf.	two-horned s.
coccineum Muhl.	swamp s.
convolvulus L.	wild buckwheat *
cuspidatum var. compactum (Hook.) Bailey	fleeceflower
hydropiper L.	marshpepper s.
hydropiperoides Michx.	mild s.
lapathifolium L.	curltop s.
pensylvanicum L.	Pennsylvania s.
persicaria L.	ladysthumb s. *
punctatum Ell.	dotted s.
ramosissimum Michx.	bushy k.
sagittatum L.	arrowleaf s.
scandens L.	climbing falsebuckwheat
tenue Michx.	slender k.
virginianum L.	Virginia k.
POLYTAENIA nuttallii DC.	prairie-parsley
PORTULACA oleracea L.	common purslane *
POTENTILLA L.	cinquefoil
arguta Pursh	tall c.
hippiana Lehm.	horse c.
norvegica L.	Norwegian c.
paradoxa Nutt.	bushy c.
pensylvanica L.	Pennsylvania c.
recta L.	sulphur c. *
rivalis Nutt.	brook c.
PROBOSCIDEA louisianica (Mill.) Thell.	devilsclaw

PRUNELLA vulgaris L.	selfheal
PTEROSPORA andromedea Nutt.	pinedrops
PYCNANTHEMUM Michx.	mountain-mint
pilosum Nutt.	woods m.
virginianum (L.) Durand & Jackson	Virginia m.
PYROLA secunda L.	onesided wintergreen
RANUNCULUS L.	buttercup; crowfoot
abortivus L.	early wood b.
aquatilis L. var. capillaceus (Thuill.) DC.	white water c.
cymbalaria Pursh	shore b.
fascicularis Muhl.	early b.
flabellaris Raf.	threadleaf b.
longirostris Godr.	longbeak b.
macounii Britt.	Macouns b.
pensylvanicus L.	Pennsylvania b.
recurvatus Poir.	hooked b.
rhomboideus Goldie	prairie b.
sceleratus L.	cursed c.
septentrionalis Poir.	marsh b.
RAPHANUS sativus L.	radish *
RHEUM rhaponticum L.	rhubarb *
RORIPPA Scop.	watercress
palustris (L.) Bess.	bog w.
sessiliflora (Nutt.) Hitchc.	sessile w.
sinuata (Nutt.) Hitchc.	spreading w.
truncata (Jeps.) Stuckey	blunt w.
ROTALA ramosior (L.) Koehne var. interior Fern. & Griscom	toothcup
RUELLIA humilis Nutt.	fringeleaf ruellia
RUMEX L.	dock
acetosella L.	sheep sorrel *
altissimus Wood	pale d.
crispus L.	curly d. *
maritimus L. var. fueginus (Phil.) Dusen	golden d. *
mexicanus Meissn.	willowleaf d.
obtusifolius L.	bitter d.
orbiculatus Gray	greatwater d.
patientia L.	patience d. *
stenophyllus Ledeb.	dock

venosus Pursh	veiny d.
verticillatus L.	water d.
SALICORNIA rubra A. Nels.	glasswort
SALSOLA L.	saltwort
collina Pall.	saltwort
iberica Sennen & Pau (S. kali)	russianthistle
SALVIA L.	sage
pitcheri Torr.	Pitchers s.
reflexa Hornem.	lanceleaf s.
SANGUINARIA canadensis L.	bloodroot
SANICULA L.	sanicle
canadensis L.	Canada s.
gregaria Bickn.	cluster s.
marilandica L.	black snakeroot
SAPONARIA officinalis L.	bouncingbet *
SCROPHULARIA L.	figwort
lanceolata Pursh	lanceleaf f.
marilandica L.	Maryland f.
SCUTELLARIA L.	skullcap
galericulata L.	marsh s.
lateriflora L.	blue s.
parvula Michx. var. leonardi (Epl.) Fern.	small s.
SEDUM L.	stonecrop
acre L.	goldmoss s.
album L.	white s.
dasyphyllum L.	hairyleaf s.
lanceolatum Torr.	stonecrop
sarmentosum Bunge	stoloniferous s.
spurium Bieb.	false s.
SEMPERVIVUM tectorum L.	hen-and-chickens
SEYMERIA macrophylla Nutt.	mullein foxglove
SICYOS angulatus L.	burcucumber
SIDA spinosa L.	prickly sida *
SILENE L.	catchfly
antirrhina L.	sleepy c.
cucubalus Wibel	bladder c. *

noctiflora L.	night-flowering c. *
stellata (L.) Ait.	starry c.
SISYMBRIUM L.	mustard
altissimum L.	tumbling m. *
loeselii L.	tallhedge m. *
officinale (L.) Scop.	hedge m. *
SIUM suave Walt.	waterparsnip
SOLANUM L.	nightshade
americanum Mill.	black n.
carolinense L.	horsenettle
dulcamara L.	bittersweet n. *
rostratum Dunal	buffalobur
triflorum Nutt.	cutleaf n.
villosum Mill.	hairy n. *
SPERMOLEPIS inermis (Nutt.) Math. & Const.	spreading spermolepis
SPHAERALCEA coccinea (Pursh) Rydb.	scarlet globemallow
STACHYS L.	betony
byzantina C. Koch	lambs-ears
palustris L. var. pilosa (Nutt.) Fern.	hedgenettle b.
tenuifolia Willd.	slenderleaf b.
STANLEYA pinnata (Pursh) Britt.	princeplume
STEIRONEMA (See LYSIMACHIA)	
STELLARIA L.	chickweed
longifolia Muhl. ex Willd.	longleaf c.
media (L.) Cyr.	common c. *
STENOSIPHON linifolius (Nutt.) Heynh.	stenosiphon
SUAEDA depressa (Pursh) S. Wats.	Pursh seepweed
TALINUM Adans.	fameflower
calycinum Engelm.	rockpink f.
parviflorum Nutt.	prairie f.
TEUCRIUM L.	germander
canadense L. var. occidentale (Gray) McCl. & Epl.	hairy g.
canadense L. var. virginicum (L.) Eat.	American g.
THALICTRUM L.	meadowrue
dasycarpum Fisch. & Lall.	purple m.
venulosum Trel.	early m.

THASPIUM trifoliatum (L.) Gray	threeleaf thaspium
THELYPODIUM integrifolium (Nutt.) Endl.	thelypody
THLASPI L.	pennycress
arvense L.	field p. *
perfoliatum L.	perfoliate p.
THYMUS serphyllum L.	creeping thyme
TRIBULUS terrestris L.	puncturevine *
TRIODANIS Raf.	Venus-lookingglass
biflora (R. & P.) Greene	two-flower v.
holzingeri McVaugh	Holzingers v.
leptocarpa (Nutt.) Nieuw.	slenderfruit v.
perfoliata (L.) Nieuw.	clasping v.
TRIOSTEUM perfoliatum L.	horsegentian
URTICA dioica L.	stinging-nettle
UTRICULARIA L.	bladderwort
minor L.	lesser b.
vulgaris L.	common b.
VACCARIA segetalis (Necker) Gke.	cowherb *
VERBASCUM L.	mullein
blattaria L.	moth m. *
thapsus L.	common m. *
VERBENA L.	verbena
bipinnatifida Nutt.	cutleaf v.
bracteata Lag. & Rodr.	bracted v.
canadensis (L.) Britt.	rose v.
hastata L.	blue v.
simplex Lehm.	narrowleaf v.
stricta Vent.	woolly v.
urticifolia L.	white v.
VERONICA L.	speedwell
agrestis L.	field s.
americana (Raf.) Schwein.	American s.
anagallis-aquatica L.	water s.
arvensis L.	corn s. *
catenata Penn.	chain s.
incana L.	woolly s.
latifolia L. (V. teucrium L.)	Hungarian s.
peregrina L. var. peregrina	purslane s.

peregrina L. var. xalapensis (HBK) St. John & Warren	purslane s.
repens Loisel.	creeping s.
VERONICASTRUM virginicum (L.) Farw.	culversroot
VINCA minor L.	periwinkle
VIOLA L.	violet
canadensis L. var. rugulosa (Greene) C. L. Hitchc.	Canada v.
missouriensis Greene	Missouri v.
nephrophylla Greene	kidneyleaf v.
nuttallii Pursh	Nuttall v.
pedatifida G. Don	prairie v.
pratincola Greene	meadow v.
pubescens Ait.	downyyellow v.
rafinesquii Greene	johnny-jump-up
sororia Willd.	downyblue v.
viarum Pollard	roadside v.
WALDSTEINIA fragarioides (Michx.) Tratt.	barren-strawberry
ZIZIA aurea (L.) Koch	golden alexanders

WOODY PLANTS

ABELIA X grandiflora Rehder	glossy abelia *
ABIES Mill.	fir
balsamea (L.) Mill.	balsam f. *
concolor Lindl.	white f. *
fraseri Pursh.	Fraser f. *
veitchii Lindl.	Veitch f. *
ACANTHOPANAX sieboldianus Makino	Siebolds acanthopanax
ACER L.	maple
campestre L.	hedge m. *
ginnala Maxim.	Amur m. *
glabrum Torr.	Rocky Mountain m.
griseum Pax	paperbark m. *
negundo L.	boxelder
nigrum Michx.	black m. *
palmatum Thunb.	Japanese m. *
platanoides L.	Norway m. *
'Crimson King'	Crimson King m. *
rubrum L.	red m. *

saccharinum L.	silver m.
'Blair'	Blair m. *
'Silver Queen'	Silver Queen m. *
saccharum Marsh.	sugar m. *
tataricum L.	tatarian m. *
AESCULUS L.	buckeye; horsechestnut
glabra Willd.	Ohio b.
hippocastanum L.	horsechestnut *
octandra Marsh.	yellow b. *
pavia L.	red b. *
AILANTHUS altissima Swingle	tree-of-heaven *
AKEBIA quinata Decne.	fiveleaf akebia *
ALNUS B. Ehrh.	alder
glutinosa Gaertn.	European a. *
rugosa Spreng.	speckled a. *
AMELANCHIER Med.	serviceberry
alnifolia Nutt.	Saskatoon s.
arborea Fern.	shadblow s.
canadensis Med.	thicket s. *
humilis Wieg.	low s.
laevis Wieg.	Allegheny s. *
AMORPHA L.	amorpha
canescens Pursh	leadplant a.
fruticosa L.	indigobush a.
nana Nutt.	dwarf indigo a.
AMPELOPSIS Michx.	ampelopsis
acontifolia Bunge	monkshood-vine *
brevipedunculata Trautv.	porcelain a. *
cordata Michx.	heartleaf a.
ARALIA spinosa L.	devils walkingstick *
ARONIA Med.	chokeberry
arbutifolia Ell.	red c. *
melanocarpa Ell.	black c. *
prunifolia Rehder.	purple fruit c. *
ARTEMISIA L.	artemisia; sagebrush; sagewort
albula Woot.	silver king a. *
cana Pursh	silver s.
filifolia Torr.	sand s.
frigida Willd.	fringed sw.

stelleriana Bess.	dustymiller *
tridentata Nutt.	big s.
ASIMINA triloba Dunal	pawpaw
ATRIPLEX L.	saltbush
argentea Nutt.	silverscale s. *
canescens James	fourwing s.
nuttallii S. Wats.	Nuttall atriplex
patula L.	spreading orach *
BERBERIS L.	barberry
julianae Schneid.	wintergreen b. *
koreana Palib.	Korean b. *
X mentorensis L. M. Ames.	mentor b. *
thunbergii DC.	Japanese b. *
var. atropurpurea	purpleleaf Japanese b.
verruculosa Hemsl. & Wils.	warty b. *
vulgaris L.	European b. *
BETULA L.	birch
alleghaniensis Britton	yellow b. *
fontinalis Sarg.	water b.
maximowicziana Reg.	monarch b. *
nigra L.	river b. *
papyrifera Marsh.	paper b.
pendula Roth	European white b. *
'Delecarlica'	cutleaf b. *
populifolia Marsh.	gray b. *
BUDDLEIA davidii Franch.	orange-eye butterflybush
BUXUS L.	boxwood
microphylla Sieb. & Zucc.	littleleaf b. *
var. koreana	Korean b. *
CALLICARPA L.	beautyberry
dichotoma Koch	beautyberry *
japonica Thunb.	Japanese b. *
CALYCANTHUS floridus L.	Carolina allspice *
CAMPSIS radicans Seem.	trumpet-vine
CARAGANA Lam.	peashrub
arborescens Lam.	Siberian p. *
aurantica Koehne	pygmy p. *
CARPINUS L.	hornbean
betulus L.	European h. *
caroliniana Walt.	American h. *

CARYA Nutt.	hickory
cordiformis Koch	bitternut h.
illinoensis Koch	pecan *
laciniosa Loud.	shellbark h. *
ovata Koch	shagbark h.
texana Buckl.	black h. *
tomentosa Nutt.	mockernut h. *
CARYOPTERIS Bunge	bluebeard
X cladonensis Simmonds	bluebeard *
incana Miq.	bluebeard *
CASTANEA Mill.	chestnut
dentata Borkh.	American c. *
mollissima Blume	Chinese c. *
CATALPA Scop.	catalpa
bignonioides Walt.	southern c. *
'Nana'	umbrella c. *
speciosa Warder	northern c.
CEANOTHUS L.	ceanothus
americanus L.	jerseytea c.
ovatus Desf.	inland c.
CELASTRUS scandens L.	American bittersweet
CELTIS L.	hackberry
laevigata Willd.	sugarberry
occidentalis L.	hackberry
CEPHALANTHUS occidentalis L.	buttonbush
CERCIDIPHYLLUM japonicum Sieb. & Zucc.	katsuratree *
CERCIS L.	redbud
canadensis L.	eastern r.
var. alba Rehd.	whitebud *
CERCOCARPUS HBK	mountain-mahogany
betuloides Nutt.	birchleaf m. *
montanus Raf.	mountain-mahogany
CHAENOMELES Lindl.	flowering-quince
japonica Lindl.	dwarf Japanese f.
lagenaria Koidz.	Japanese f.
CHAMAEBATIARIA millefolium Maxim.	tansybush *
CHIONANTHUS virginicus L.	fringetree *

CHRYSOTHAMNUS Nutt.	rabbitbrush
nauseosus (Pall.) Britt.	rubber r.
var. graveolens H. & C.	greenplume r.
parryi Nutt.	Parry r.
var. howardi H. & C.	Howard r. *
viscidiflorus Nutt.	twistleaf r. *
CLADRASTIS lutea Koch	yellowwood *
CLEMATIS L.	clematis
crispa L.	blue jasmine *
florida Thunb.	cream c. *
X jackmanni Moore	Jackman c. *
lanuginosa Lindl.	Ningpo c.
ligusticifolia Nutt.	virgins bower *
paniculata Thunb.	sweet autumn c. *
patens Morr. & Decne.	lilac c. *
tangutica Korsh.	golden c. *
texensis Buckl.	scarlet c. *
viticella L.	vinebower
CLETHRA acuminata Michx.	cinnamon clethra *
COLUTEA arborescens L.	bladder-senna *
CORNUS L.	dogwood
alba L.	tatarian d. *
alternifolia L.f.	pagoda d. *
amomum Mill.	silky d.
baileyi Coult. & Evans	Bailey d. *
drummondii C.A. Mey.	roughleaf d.
florida L.	flowering d. *
kousa Hance	Japanese d. *
var. chinensis Osborn	Chinese d. *
mas L.	Cornelian cherry *
racemosa Lam.	gray d.
sanguinea L.	red d. *
stolonifera Michx.	redosier d.
'Kelseyi'	Kelsey d. *
CORYLUS L.	hazelnut; filbert
americana Walt.	American h.
avellana L.	European f. *
'Contorta'	Harry Lauders walkingstick *
colurna L.	Turkish f. *
maxima Mill.	giant f. *
var. purpurea Rehd.	purple leaf f. *
COTINUS Mill.	smoketree
coggygria Scop.	smoketree *
obovatus Raf.	American s. *

COTONEASTER Ehrh.	cotoneaster
acutifolia Turcz.	Peking c. *
apiculata Rehd. & Wils.	cranberry c. *
divaricata Rehd. & Wils.	spreading c. *
horizontalis Decne.	rockspray c. *
integerrima Med.	European c. *
lucida Schlecht.	hedge c. *
multiflora Bunge	manyflower c. *
CRATAEGUS L.	hawthorn
calpodendron Medic.	pear h. *
chrysocarpa Ashe	red haw *
coccinioides Ashe	Kansas h. *
crus-galli L.	cockspur h. *
mollis Scheele	downy h.
monogyna Jacq.	singleseed h. *
oxycantha L.	English h. *
'Crimson Cloud'	Crimson Cloud h. *
phaenopyrum Medic.	Washington h. *
punctata Jacq.	dotted h. *
succulenta Schrad.	fleshy h.
CYDONIA oblonga Mill.	quince *
CYTISUS scoparius Link	scotch broom *
DAPHNE cneorum L.	rose daphne *
DEUTZIA Thunb.	deutzia
gracilis Sieb. & Zucc.	slender d. *
X lemoinei Lemoine	Lemoine d. *
scabra Thunb.	fuzzy d. *
DIERVILLA Adans.	bush-honeysuckle
lonicera Mill.	dwarf b. *
sessifolia Buckl.	southern b. *
DIOSPYROS virginiana L.	persimmon *
ELAEAGNUS L.	elaeagnus
angustifolia L.	Russianolive *
umbellata Thunb.	autumnolive *
ELSHOLTZIA stauntoni Benth.	Staunton elsholtzia *
ERIOGONUM effusum Nutt.	umbrellaplant
EUCOMMIA ulmoides Oliv.	hardy rubbertree *
EUONYMUS L.	euonymus; spindletree
alatus Reg.	winged e. *
'Compactus'	compact winged e. *

americanus L.	strawberry-bush *
atropurpureus Jacq.	eastern wahoo
bungeana Maxim.	winterberry e. *
europaeus L.	European burningbush
fortunei Hand.-Mazz.	wintercreeper *
'Carrerei'	glossy w. *
coloratus Rehd.	purpleleaf w. *
radicans Rehd.	wintercreeper *
'Gracillis'	variegated w. *
'Sarcoxie'	sarcoxie e. *
'Vegetus'	bigleaf w. *
kiautschovicus Loes.	spreading e. *
nanus Dieck.	dwarf e. *
var. turkistanicus Dieck.	dwarf e. *
yedoensis Koehne	yeddoe e. *
EUROTIA lanata Moq.	winterfat
EVODIA danielli Hemsl.	Korean evodia *
EXOCHORDA racemosa Lindl.	pearlbush *
FAGUS L.	beech
grandifolia Ehrh.	American b. *
sylvatica L.	European b. *
FALLUGIA paradoxa Endl.	Apacheplume *
FORESTIERA neo-mexicana Gray	New Mexico forestiera *
FORSYTHIA Vahl	forsythia
X intermedia X japonica	Arnold dwarf f. *
X intermedia Zabel	border f. *
suspensa Vahl	weeping f. *
viridissima Lindl.	greenstem f. *
FOTHERGILLA L.	fothergilla
gardenii Murr.	dwarf f. *
major Lodd.	large f. *
FRAXINUS L.	ash
americana L.	white a. *
anomala S. Wats.	singleleaf a. *
exelsior L.	European a. *
mandshurica Rupr.	Manchu a. *
nigra Marsh.	black a. *
pennsylvanica Marsh.	green a.
quadrangulata Michx.	blue a. *
GENISTA tinctoria L.	woadwaxen *
GINKGO biloba L.	ginkgo *

GLEDITSIA triacanthos L.	honeylocust
GUTIERREZIA sarothrae Britt. & Rusby	broom snakeweed
GYMNOCLADUS dioica Koch	Kentucky coffeetree
HALESIA Ellis	silverbell
carolina L.	Carolina s. *
monticola Sarg.	mountain s. *
HAMAMELIS L.	witch-hazel
mollis Oliv.	Chinese w. *
vernalis Sarg.	vernal w. *
virginiana L.	witch-hazel *
HEDERA helix L.	English ivy *
HEMIPTELEA davidii Planch.	hemiptelea *
HIBISCUS syriacus L.	shrubalthea *
HIPPOPHAE rhamnoides L.	sea buckthorn *
HOVENIA dulcis Thunb.	Japanese raisin-tree *
HYDRANGEA L.	hydrangea
arborescens L.	smooth h. *
'Grandiflora'	hills-of-snow h. *
paniculata Sieb.	panicle h. *
'Grandiflora'	peegee h. *
petiolaris Sieb. & Zucc.	climbing h. *
quercifolia Bartr.	oakleaf h. *
HYPERICUM kalmianum L.	Kalm St. johnswort *
IBERIS sempervirens L.	candytuft *
ILEX L.	holly
decidua Walt.	deciduous h. *
opaca Ait.	American h. *
verticillata Gray	common winterberry *
INDIGOFERA kirilowii Maxim.	Kirilow indigo *
ITEA virginica L.	Virginia sweetspire *
JUGLANS L.	walnut
ailantifolia Carr.	heartnut *
cinerea L.	buternut *
nigra L.	black w.
regia L.	Persian w. *

JUNIPERUS L.	juniper
chinensis L.	Chinese j. *
var. pfitzeriana Spaeth	pfitzer j. *
'Hetzii'	hetzi j. *
communis L.	common j.
horizontalis Moench	creeping j.
'Plumosa'	Andorra j. *
sabina L.	Savin j. *
scopulorum Sarg.	Rocky Mountain j.
squamata Lamb.	singleseed j. *
virginiana L.	eastern redcedar
KALMIA latifolia L.	mountain-laurel *
KALOPANAX pictus Thunb.	castor-aralia *
KERRIA japonica DC.	Japanese kerria
KOELREUTERIA paniculata Laxm.	goldenraintree *
KOLKWITZIA amabilis Graebn.	beautybush *
LABURNUM Med.	laburnum
alpinum Bercht. & Prsl.	Scotch l. *
anagyroides Med.	golden-chain l. *
X waterei Dippel	waterer l. *
LARIX Mill.	larch
decidua Mill.	Euorpean l. *
X eurolepis Henry.	Dunkeld l. *
kaempferi Sarg.	Japanese l. *
laricina Koch	tamarack *
LAVANDULA angustifolia Mill.	lavender *
LEUCOTHOE fontanesiana Sleum	fetterbush *
LIGUSTRUM L.	privet
amurense Carr	Amur p.
obtusifolium Sieb. & Zucc.	border p.
var. regelianum Rehd.	Regel p.
vulgare L.	European p.
LINDERA benzoin Blume	spicebush *
LIQUIDAMBAR styraciflua L.	sweetgum *
LIRIODENDRON tulipifera L.	yellow-poplar *
LONICERA L.	honeysuckle
dioica L.	limber h.
fragrantissima Lindl. & Paxt.	winter h. *

X heckrottii Rehd.	everblooming h. *
japonica Thunb.	Japanese h. *
'Halliana'	Halls h.
korolkowii Stapf.	blueleaf h. *
maackii Maxim.	Amur h. *
morrowii Gray	Morrow h. *
prolifera Rehd.	grape h. *
sempervirens L.	trumpet h.
syringantha Maxim.	lilac h. *
tatarica L.	tatarian h.
var. Zabeli	Zabel h. *
LYCIUM L.	box-thorn
chinense Mill.	Chinese wolfberry *
halimifolium Mill.	matrimonyvine *
MAACKIA amurensis Rupr.	Amur maackia *
MACLURA pomifera Schneid.	osage-orange
MAGNOLIA L.	magnolia
acuminata L.	cucumbertree *
X loebneri Kache.	Loebner m. *
X soulangeana Soul.	saucer m. *
stellata Maxim.	star m. *
MAHONIA Nutt.	mahonia
aquifolium Nutt.	Oregongrape
repens (Lindl.) Dor.	creeping m.
MALUS Mill.	apple; crabapple
X arnoldiana Sarg.	Arnold c. *
baccata Borkh.	Siberian c. *
floribunda Sieb.	Japanese flowering c. *
hupehensis Rehd.	tea c. *
ioensis Britton	prairie c. *
pumila Mill.	apple *
sargentii Rehd.	Sargent c. *
sieboldii Rehd.	toringo c. *
METASEQUOIA glyptostroboides Hu et Cheng	dawn-redwood *
MORUS L.	mulberry
alba L.	white m. *
var. tatarica Seringe	Russian m. *
rubra L.	red m. *
MYRICA pensylvanica Loisel	northern bayberry *
OSTRYA virginiana Koch	American hophornbeam

PARROTIA persica C.A. Mey.	Persian parrotia *
PARTHENOCISSUS Planch.	creeper
inserta K. Fritsch	thicket c.
quinquefolia L.	Virginia c.
tricuspidata Planch.	Boston ivy *
PAULOWNIA tomentosa Steud.	royal paulownia *
PAXISTIMA canbyi Gray.	Canby paxistima *
PHELLODENDRON Rupr.	corktree
amurense Rupr.	Amur c. *
chinensis Schneid.	oriental c. *
PHILADELPHUS L.	mockorange
coronarius L.	sweet m. *
grandiflorus Willd.	big scentless m. *
X lemoinei Lemoine	Lemoine m. *
X virginalis Rehd.	virginal m. *
PHYSOCARPUS Maxim.	ninebark
opulifolius Maxim.	ninebark
var. nanus Zabel	dwarf n. *
PICEA A. Dietr.	spruce
abies Karst.	Norway s. *
engelmanii Parry	Engelman s. *
glauca Voss	white s. *
var. albertiana Serg.	dwarf Alberta s. *
'Densata'	Black Hills s. *
omorika Purkyne	Servian s. *
orientalis Link.	oriental s. *
pungens Engelm.	blue s. *
rubens Sarg.	red s. *
PINUS L.	pine
aristata Engelm.	bristlecone p. *
banksiana Lamb.	Jack p. *
bungeana Zucc.	lacebark p. *
densiflora Sieb. & Zucc.	Japanese red p. *
edulis Engelm.	pinyon p. *
flexilis James	limber p.
koraiensis Sieb. & Zucc.	Korean p. *
mugo Turra	mugo p. *
nigra Arnold	Austrian p. *
peuce Griseb.	Macedonian p. *
ponderosa Lawson	ponderosa p.
var. scopulorum Engelm.	Rocky Mountain p. *
pungens Lamb.	table-mountain p. *
resinosa Ait.	red p. *

rigida Mill.	pitch p. *
strobiformis Engelm.	southwestern white p. *
strobus L.	eastern white p. *
sylvestris L.	Scotch p. *
tabulaeformis Carr.	Chinese p. *
PLATANUS L.	sycamore; planetree
X acerifolia Willd.	London p. *
occidentalis L.	American s.
orientalis L.	oriental p. *
POPULUS L.	cottonwood; poplar
X acuminata Rydb.	lanceleaf c.
alba L.	white p.
angustifolia James	narrowleaf c.
balsamifera L.	balsam p. *
X canadensis Moench	hybrid p. *
'Eugenii'	Carolina p. *
*deltoides Bartr.	eastern c.
var. occidentalis Rydb.	plains c. *
nigra L.	black p. *
'Italica'	Lombardy p. *
tremuloides Michx.	quaking aspen
POTENTILLA fruticosa L.	shrubby cinquefoil *
PRINSEPIA sinensis Oliv.	cherry prinsepia *
PRUNUS L.	cherry; peach; plum
americana Marsh.	American p.
angustifolia Marsh	chickasaw p.
armeniaca L.	apricot *
besseyi Bailey	western sandcherry
cerasifera Ehrh.	cherry p.
'Atropurpurea'	pissard p.
X cistena N.E. Hansen	purpleleaf sandcherry *
cerasus L.	sour c. *
fruticosa Pall.	ground c. *
glandulosa Thunb.	dwarf flowering almond *
hortulana Bailey	hortulan p. *
mexicana S. Wats.	big tree p.
padus L.	European birdcherry *
'Commutata'	mayday tree *
persica Batsch	peach *
serotina Ehrh.	black c.
serrulata Lindl.	Japanese flowering c. *
sibirica L.	Siberian apricot *
subhirtella Miq.	rosebud c. *
tomentosa Thunb.	Manchu c. *

*Nebraska State Tree

triloba Lindl.	flowering almond *
virginiana L.	common chokecherry
'Shubert'	shubert chokecherry
PSEUDOTSUGA menziesii Franco	douglas-fir *
PTELEA trifoliata L.	waferash *
PTEROCARYA fraxinifolia Spach.	Caucasian wingnut *
PTEROSTYRAX hispida Sieb. & Zucc.	epaulettetree *
PYRACANTHA coccinea Roem.	scarlet firethorn *
PYRUS L.	pear
calleryana Dcne.	Callery p.
'Bradford'	Bradford p.
communis L.	common p.
QUERCUS L.	oak
acutissima Carruth.	sawtooth o. *
alba L.	white o. *
bicolor Willd.	swamp white o. *
coccinea Muenchh.	scarlet o. *
gambelii Nutt.	Gambel o. *
imbricaria Michx.	shingle o. *
macrocarpa Michx.	bur o.
marilandica Muenchh.	blackjack o.
muehlenbergii Engelm.	chinkapin o.
palustris Muenchh.	pin o. *
prinoides Willd.	dwarf chinkapin o.
prinus L.	chestnut o. *
robur L.	English o. *
rubra L.	northern red o.
shumardii Buckl.	Shumard o. *
stellata Wang.	post o.
velutina Lam.	black o.
RHAMNUS L.	buckthorn
alnifolia L'Her.	alder b. *
caroliniana Walt.	Carolina b. *
cathartica L.	European b. *
davurica Pall.	Dahurian b. *
frangula L.	glossy b. *
'Columnaris'	tall hedge *
lanceolata Pursh	lanceleaf b.
RHODOTYPOS scandens Mak.	black jetbead *
RHUS L.	sumac
aromatica Ait.	fragrant s.
copallina L.	flameleaf s.

glabra L.	smooth s.
radicans L.	poisonivy
trilobata Nutt.	skunkbush
typhina L.	staghorn s. *
RIBES L.	gooseberry; currant
alpinum L.	alpine c.
americanum Mill.	American black c.
cereum Dougl.	wax c.
cynosbati L.	pasture g. *
missouriense Nutt.	Missouri g.
odoratum Wendl.	clove c.
oxyacanthoides L.	northern g.
setosum Lindl.	redshoot g.
ROBINIA L.	locust
neo-mexicana Gray	New Mexican l. *
pseudoacacia L.	black l. *
viscosa Vent.	clammy l. *
ROSA L.	rose
acicularis Lindl.	prickly r.
arkansana Porter	Arkansas r.
blanda Ait.	meadow r.
multiflora Thunb.	multiflora r. *
pratincola Greene	pearhip r. *
setigera Michx.	prairie r.
wichuraiana Crep.	memorial r. *
woodsii Lindl.	Woods r.
RUBUS L.	blackberry; raspberry
allegheniensis Porter	Alleghany b. *
fruticosus L.	European b. *
idaeus L.	red r. *
occidentalis L.	blackcap r.
ostryifolius Rydb.	highbush b.
pubescens Raf.	dwarf b.
SALIX L.	willow
alba L.	white w. *
var. vitellina Stokes	golden w. *
amygdaloides Anderss.	peachleaf w.
babylonica L.	weeping w. *
bebbiana Sarg.	Bebb w. *
caroliniana Michx.	Carolina w.
discolor Muhl.	pussywillow *
eriocephala Michx.	Missouri River w.
exigua Nutt.	coyote w.
fragilis L.	crack w. *
interior Rowlee	sandbar w.
lucida Muhl.	shining w. *

lutea Nutt.	yellow w.
matsudana Koidz.	Matsudana w. *
var. tortuosa Rehd.	corkscrew w. *
nigra Marsh.	black w.
pentandra L.	Laurel w. *
petiolaris Sm.	meadow w.
purpurea L.	purpleosier w. *
tristis Ait.	dwarf gray w.
SAMBUCUS canadensis L.	American elderberry
SAPINDUS drummondii Hook. & Arn.	western soapberry *
SARCOBATUS vermiculatus Torr.	black greasewood
SASSAFRAS albidum Nees	sassafras *
SCIADOPITYS verticillata Sieb. & Zucc.	umbrellapine
SHEPHERDIA Nutt.	buffaloberry
argentea Nutt.	silber b.
canadensis Nutt.	russet b. *
SMILAX L.	greenbriar
glauca Walt.	cat g. *
hispida Muhl.	bristly g.
SOPHORA L.	sophora
japonica L.	Japanese pagodatree *
nuttalliana Turner	silky s. *
SORBARIA A. Br.	false-spirea
arborea Schneid.	tree f. *
sorbifolia A. Br.	ural f. *
SORBUS L.	mountainash
alnifolia Koch	Korean m. *
americana Marsh.	American m. *
aucuparia L.	European m. *
domestica L.	domestic m. *
SPIRAEA L.	spirea
X arguta Zab.	garland s. *
X billardii Herincq.	billard s. *
X bumalda Burv.	bumalds s. *
'Anthony Waterer'	Anthony Waterer s. *
froeboli Rehd.	Froebel s. *
nipponica Maxim.	Nippon s. *
'Snowmound'	snowmound s. *
prunifolia Sieb. & Zucc.	bridalwreath s. *
X superba Zab.	striped s. *

thunbergii Sieb.	Thunberg s. *
X vanhouttei Zab.	Vanhoutte s. *
STAPHYLEA trifolia L.	American bladdernut
STEPHANANDRA incisa Zab.	cutleaf stephandra *
STEWARTIA ovata Weatherby	mountain stewartia *
STYRAX japonica Sieb. & Zucc.	Japanese snowbell *
SYMPHORICARPOS Duham.	buckbrush; snowberry
albus Blake	common s.
occidentalis Hook.	western s.
orbiculatus Moench	buckbush
SYRINGA L.	lilac
amurensis Rupr.	Amur l. *
var. japonica Fr. & Sav.	Japanese tree l. *
oblata Lindl.	early l. *
var. dilatata Rehd.	Korean early l. *
pekinensis Rupr.	Peking l. *
persica L.	Persian l. *
X prestoniae McKelvey	Preston l. *
villosa Vahl	late l. *
vulgaris L.	common l. *
TAMARIX L.	tamarisk
parviflora DC.	small flower t. *
pentandra Pall.	five-stamen t. *
TAXODIUM distichum Rich.	baldcypress *
TAXUS L.	yew
baccata L.	English y. *
cuspidata Sieb. & Zucc.	Japanese y. *
X media Rehd.	Anglojap y. *
'Brownii'	Browns y. *
'Densiformis'	densiform y. *
'Hicksii'	Hicks y. *
THUJA L.	arborvitae
occidentalis L.	northern whitecedar *
orientalis L.	Oriental a. *
plicata D. Don	western redcedar *
TILIA L.	basswood; linden
americana L.	American b.
cordata Mill.	littleleaf l. *
'Greenspire'	greenspire l. *
X euchlora Koch	Crimean l. *
'Redmond'	Redmond l. *

platyphyllos Scop.	bigleaf l. *
tomentosa Moench.	silver l. *
TSUGA canadensis Carr.	eastern hemlock *
ULMUS L.	elm
americana L.	American e.
'Moline'	Moline e. *
carpinifolia Gled.	smoothleaf e. *
'Christine Buisman'	Christine Buisman e.
glabra Huds.	Scotch e. *
parvifolia Jacq.	Chinese e. *
procera Salisb.	English e. *
pumila L.	Siberian e.
rubra Muhl.	slippery e.
thomasi Sarg.	rock e.
VIBURNUM L.	viburnum; cranberrybush
X burkwoodii Burkwood	Burkwood v. *
carlesi Hemsl.	Koreanspice v. *
cassinoides L.	witherrod v. *
dentatum L.	arrowwood v. *
dilatum Thunb.	linden v. *
lantana L.	wayfaring tree *
lentago L.	nannyberry
opulus L.	European c. *
var. nanum David	dwarf European c.
plicatum Thunb.	doublefile v. *
var. tomentosum Rehd.	Japanese snowball *
'Mariesii'	Maries doublefile v.
prunifolium L.	black-haw v. *
rhytidophyllum Hemsl.	leatherleaf v. *
sargentii Koehne	Sargent v. *
sieboldii Miq.	Siebold v. *
trilobum Marsh.	American c. *
VITIS L.	grape
acerifolia Raf.	bush g.
cinerea Engelm.	winter g.
riparia Michx.	riverbank g.
vulpina L.	frost g.
WEIGELA florida A. DC.	cardinalbush *
WISTERIA Nutt.	wisteria
floribunda DC.	Japanese w. *
sinensis Sweet	Chinese w. *
XANTHOCERAS sorbifolia Bunge	shinyleaf yellowhorn *
XANTHORHIZA simplicissima Marsh.	yellowroot *

ZANTHOXYLUM L.	pricklyash
americanum Mill.	common p.
clava-herculis L.	herculesclub *
ZELKOVA Spach	zelkova
carpinifolia Koch	elm z. *
serrata Makino	Japanese z. *
ZIZIPHUS jujuba Mill.	jujube *

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